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American Public Health Association

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1901

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TABLE OF CONTENTS.

PAGE

President's Address. By Benjamin Lee, M. D. 1

Address of Welcome. By Ansley Wilcox 14

Response of the President to the Address of Welcome. By Benjamin Lee, M. D. 17

On the Progress of Public Health Organizations in the United States. By Stephen Smith, M. D. 19

Report of Committee on Transportation of Diseased Tissue by Mail. By F. F. Wesbrook, M. D., Chairman 27

Report of the Committee on National Leper Homes. By Henry M. Bracken, M. D., Chairman 34

The British Congress on Tuberculosis, July 22-27, 1901. By F. Montizambert, M. D. 35

Report of Committee on Animal Diseases and Animal Food. By D. E. Salmon, D. V. M., Chairman 45

Summary of a Paper Giving Some Facts which Tend to Show that Bovine Tuberculosis Can Be the Source of the Same Disease in Man. By Jésus Chico, M. D. 78

Tuberculosis: Heredity. By Felix Formento, M. D. 81

Summary of a Paper on Sanatoria for Consumptives. By A. Carriedo, M. D. 85

Report of Committee on Teaching of Hygiene and Granting of Diploma of Doctor of Public Health. By W. T. Sedgwick, Chairman 87

Instruction in Hygiene for Architects and Engineers. By W. T. Sedgwick 92

University Teaching in Hygiene. By A. C. Abbott, M. D. 94

Typhoid Fever Death Rates in American Cities. By George W. Fuller, Chairman 100

The Legal Aspects of Water Pollution. By J. L. Leal, M. D. 103

The Prevention of Yellow Fever. By Walter Reed, M. D., and James Carroll, M. D. 113

PAGE

The Results of Yellow Fever Sanitation in Havana, Cuba, for the Year 1901 Up to September 1st, Carried on Upon the Basis that the Stegomyia Mosquito is the Sole Means of Its Transmission. By W. C. Gorgas, M. D..... 130

Practical Discussion of Yellow Fever. By Alvah H. Doty, M. D.. 134

Fomites and Yellow Fever. By A. N. Bell, M. D..... 144

Tenth Report on Yellow Fever in Mexico. By Eduardo Licéaga, M. D..... 152

A Brief Statement of the Sanitary Work So Far Accomplished in the Philippine Islands, and of the Present Shape of Their Sanitary Administration. By Charles R. Greenleaf, M. D..... 157

Sanitation in Porto Rico. By William F. Smith, M. D..... 166

Vaccinal Immunization from the Health Officer's Standpoint. By Peter H. Bryce, M. D..... 175

Remarks Intended to Show the Innocuous Character of Humanized Vaccine as a Preventative of Smallpox. By Francisco De Bernaldez, M. D..... 182

Report of the Committee on Disposal of Refuse Materials. By Rudolph Hering, Chairman..... 184

Refuse Disposal in Boston. By Hibbert Winslow Hill, M. D..... 186

Refuse Disposal in the District of Columbia. By William C. Woodward, M. D..... 194

The Bacterial Purification of Water by Freezing. By H. W. Clark..... 204

Report of the Committee on the Relation of Forestry to the Public Health. By Prof. William H. Brewer, Chairman..... 209

Circular of the American Public Health Association Issued by the Committee on Car Sanitation. By Prof. S. H. Woodbridge, Chairman..... 224

Report of the Committee on Cause, Prevention and Duration of Infectious Diseases. By A. Walter Suiter, M. D., Chairman.... 227

Present Status of Diphtheria. By William C. Woodward, M. D.... 238

Typhoid Fever. By Frank W. Wright, M. D..... 241

Report of Committee on Disinfectants and Disinfection. By Hibbert Winslow Hill, M. D., Acting Chairman..... 244

Report of Sub-Committee on Standard Cultures and the Method of Using Them. By E. H. Wilson, M. D., Chairman..... 247

Observations on the Practice of Disinfection in the Federal District of Mexico. By Fernando Lopez, M. D..... 253

PAGE

REPORT OF THE COMMITTEE ON PUBLIC HEALTH LEGISLATION. By U. O. B. WINGATE, M. D., Chairman..... 256

REPORT OF COMMITTEE ON SCHOOL HYGIENE. By HENRY MITCHELL, M. D., Chairman..... 260

NOTES ON THE NECESSITY OF ATTENDING TO THE HYGIENE OF THE MOUTH AMONGST THE PUPILS OF SCHOOLS. By JUAN BREÑA, M. D..... 286

THE INFLUENCE OF SCHOOL LIFE OVER HEALTH. By FRANK W. WRIGHT, M. D..... 297

A SUMMARY OF A PAPER ON THE ADVISABILITY OF ENTRUSTING TO PHYSICIANS AND NOT TO TEACHERS, THE MEDICAL SUPERVISION OF PUPILS. By IGNACIO GUZMAN, M. D..... 304

REPORT OF THE COMMITTEE ON DEMOGRAPHY AND STATISTICS IN THEIR SANITARY RELATION. By JOHN S. FULTON, M. D., Chairman..... 305

SOME OF THE CAUSES OF INFANT MORTALITY IN NURSERIES AND ASYLUMS, AND THEIR PREVENTION. By ELIAS H. BARTLEY, M. D..... 306

SUMMARY OF A PAPER ON CREMATION IN RELATION TO SANITARY LEGISLATION. By LUIS G. ESPINOZA, M. D..... 314

SOME RESULTS OF THE ARMY CANTEEN OR POST EXCHANGE FROM THE STANDPOINT OF DISCIPLINE AND HYGIENE. By EDWARD L. MUNSON, M. D..... 315

ANTI-RABIC DEPARTMENT OF THE SUPREME BOARD OF HEALTH OF MEXICO. By EDUARDO LICÉAGA, M. D..... 318

OFFICIAL REPORT OF THE PROCEEDINGS OF THE TWENTY-NINTH ANNUAL MEETING..... 319

PROCEEDINGS OF THE SECTION OF BACTERIOLOGY AND CHEMISTRY..... 377

REPORT OF COMMITTEE ON STANDARD METHODS OF WATER ANALYSIS. By GEORGE W. FULLER, Chairman..... 377

STUDIES OF MEDIA FOR THE QUANTITATIVE ESTIMATION OF BACTERIA IN WATER AND SEWAGE. By STEPHEN DEM. GAGE AND EARLE B. PHELPS..... 392

IS THE COLON BACILLUS A NORMAL INHABITANT OF THE INTESTINES OF FISHES? By JOHN A. AMYOT, M. B..... 400

SOME COMMON BACTERIA IN AMERICAN STREAMS, INCLUDING SOME NEW SPECIES ISOLATED AT NEW ORLEANS, LOUISIANA. By ROBERT SPURR WESTON AND ARTHUR I. KENDALL..... 402

ABSTRACT OF "REMARKS REGARDING THE INVESTIGATION OF BACILLUS COLI IN WATER." By GONZALES FABELA..... 408

THE SIGNIFICANCE OF THE PRESENCE AND AMOUNT OF CARBON DI-OXIDE IN POTABLE WATERS. By ELLEN H. RICHARDS..... 411

PAGE

Refined and Improved Antitoxin Preparations. By Joseph McFarland, M. D. ... 414

Antitoxins and Agglutinins. By Thorvald Madsen ... 417

Some Work on a Curative Serum for Typhoid Fever. By William Royal Stokes, M. D., and John S. Fulton, M. D. ... 423

Abstract of a Paper Entitled "Demonstration of the Existence of Typhoid Fever in the City of Mexico by the Widal Method." By Angel Gaviño, M. D. ... 437

Methods of Diagnosis in Glanders. By Hibbert Winslow Hill, M. D., and Alexander Burr, D. V. M. ... 439

The Viability of the Plague Bacillus in Its Relations to the Public Health. By M. J. Rosenau, M. D. ... 448

Cultivation of the Bacillus Influenza. By Adolph Gehrmann, M. D. ... 458

The Bacterial Contamination of City Milk—Is it Harmful? Should it be Controlled by Health Authorities? By William Hallock Park, M. D. ... 461

The Non-Nitrification of Septic Sewage in Contact Filters. By H. W. Clark ... 464

Some Points in the Life History and in the Decomposition of Blue-Green Algae as Illustrated by Oscillaria Prolifica (with Samples). By Ellen H. Richards ... 467

Hydrocyanic-Acid Gas in Public Health Work. By John S. Fulton, M. D., and William R. Stokes, M. D ... 469

Air Testing for Engineers. By Ellen H. Richards ... 477

An Engineer's Kit for Water Inspection. By Ellen H. Richards ... 478

Constitution ... i

By-Laws of the Executive Committee ... v

Officers and Committees ... viii

Revised List of Members ... xvi

Members Elected at Buffalo Meeting ... xxv

List of Members by Geographical Distribution ... xxvii

Sanitary Authorities and Associations ... xxxv

Index ... xliii

PRESIDENT'S ADDRESS.

By BENJAMIN LEE, M. D.,

Secretary State Board of Health, Philadelphia, Pennsylvania.

Mr. Chairman and Members of the American Public Health Association, Ladies and Gentlemen—Bear with me a moment, I pray you, if I supplement the few hurried words in which at the close of our last session I tried to thank you for the distinguished honor conferred both upon my State and myself in my election to the responsible position of president of this eminent and learned body, by a farther expression of my appreciation of the distinction of the compliment thus implied, and of the high value which I place upon the office.

One who has devoted the best years of his life to the study and practice of Preventive Medicine, and who thoroughly believes that next to the ministry of religion the ministry of health constitutes the noblest calling in which man can engage, may be pardoned if he expresses the sentiment that, having thus received the verdict of approval from his long valued friends and deeply respected peers, the summit of his ambition has been attained, and earth has no richer prize to offer him. It has been claimed by others, that this Association constitutes the most important permanently organized body of sanitarians in the world. And when we remember that both the practical and the scientific sides of sanitary work have here their due representation, and that here, year after year, the devoted subjects of his gracious majesty, King Edward VII, rub shoulders with the patriotic representatives of his Excellency, President Diaz, while both give the glad hand to the citizens of the Republic which is ever eager to welcome them on their noble mission of good will to men; when it is considered that we have assurances that it may be our privilege to greet on this occasion, delegates from the far-distant Philippines, from storied Honolulu, from the Isles of the Antilles and from the immense domains of Central and South America, this certainly will not be the time nor shall I be the individual to dispute the claim. What this Association has accomplished for the United States, and in this connection, I beg leave on behalf of the members from this country to acknowledge in the fullest and heartiest manner, the assistance which we have derived from the sagacious and fraternal counsels of our good neighbors, to the north and south of us,—what this Association, I say, and the faithful workers both in the field of science and of administration who compose it, have accomplished for the United States, let the astounding results of the last census as recently furnished by the

Chief of the Vital Statistics Division, bear witness. Four years added to the average duration of human life in the brief period of ten years. In the aggregate, more than two hundred million years of life. The mind staggers under such figures. Well may we thank God and take courage.

Before proceeding to the discussion of the topic to which I shall briefly call your attention, this evening, it is fitting that reference should be made to those of our members who have passed from the sphere of their earthly labors since we last met together. Conspicuous among them rises before your mind's eye, as I speak, the alert form and genial countenance of Henry B. Horlbeck, late Health Officer of the city of Charleston, and one of your former presidents. This is not the place for his biography, nor am I competent to write his eulogy. It were well that one of his familiar friends should place the Association under obligation by preparing a sketch of his active life and his striking characteristics, for permanent record in our Transactions. But you all knew him, for he never failed to meet us year after year, and to bring to our discussions material of fresh and lively interest. His devotion to the study of the etiology of yellow fever, which he made the subject of his able presidential address at the meeting at Philadelphia, was unceasing and profound, and it must have been a matter of congratulation to him that it was permitted before his end to see a ray of light thrown upon a subject which he had so long striven in vain to illuminate. His successful career as a health officer, is sufficiently attested by the long period during which he administered that office. "*Justum ac tenacem propositi virum*" "An honest man and one tenacious of his opinions," may fairly be predicated of him. To say that we shall sadly miss him both in the arena of debate of which he was a master, and in the social gathering of which he was an ornament, is but coldly to express the esteem in which he was held.

It is not inappropriate, I trust, to mention in this connection the passing of one, who though not a fellow member, was devoted to the study of the same pursuits as ourselves, and who laid down his life a willing victim on the altar of sanitary science, in the effort, perhaps successful, to solve the very problem to which our friend Horlbeck had so long sought a solution. I refer to Acting Assistant Surgeon, Dr. Jesse W. Lazear, of the United States Army, whose death occurred in the city of Havana, just previous to our last meeting, as the result of the bite of a mosquito, infected by the blood of yellow fever patients in the Las Animas Hospital, while engaged in collecting blood from such patients for purposes of investigation and study. If Cuba does not belong to the list of those republics which are pro-

verbially ungrateful, she should show her appreciation of three of those concerned in her sanitary regeneration by erecting a monument to the joint memory of Colonel George A. Waring, Surgeon Jesse W. Lazear, and Brigadier-General William Ludlow. This last-named hero fully earned the honors that were showered upon him both in peace and war. He it was who initiated the sanitary work in the city of Havana, so successfully carried on later by General Wood. As Chief of the Water Department of the city of Philadelphia, he labored zealously, and with much success, to improve the water supply and restore the dilapidated works of that city. He was unable, however, to endure the interference of political leaders, who sought to control him for their own selfish ends, and this rendered his permanent occupancy of the position impossible. His whole career was one of honest and intelligent performance of duty.

Another whom we shall not again greet is Dr. J. H. Linsley, of Vermont, well known for his work in bacteriology.

The names also of Frank Paddock, Pittsfield, Mass.; Erastus J. Buck, Plattville, Wis.; Edward A. Guilbert, Dubuque, Io.; Allen A. Rawson, Coring, Io.; Katherine Miller, Lincoln, Ill.; must be mentioned with respectful regret.

An appropriate theme for the presidential address of the first year of the New Century, before this august body would naturally be a retrospect of the advances made in the science and art of public hygiene or, to speak more correctly, in those arts and sciences which public hygiene is builded on, during the century just closed. Unfortunately for me, however, but fortunately for the Association, my predecessor in office made so careful a study of this subject and presented the results of his labors in so forceful, scholarly and exhaustive a shape in his own address a year ago, as to make it most unwise for me to follow him upon the same lines. The situation is a little like that described by the sailing-master of the late lamented Queen Victoria, of blessed and revered memory, who, when inquired of by Her Majesty, to whom he had announced that the yacht America had won the international race: "Which yacht is second?" sententiously replied "Your Majesty, there is no second."

This particular point of time cannot be allowed to pass, however, without recognition. I hazard nothing in claiming that we stand not only on the threshold of a new century, but at the beginning of a new epoch in the history of sanitation. The past century has been one of preparation. We who have been permitted to live through many of its years have "seen wondrous things whereof we are glad," advances in chemistry, physiology, pathology and biology, the discovery of new laws of nature and the development of new sciences such as sociology,

bacteriology, and the practical application of electricity. It may be said in all soberness, that "new heavens and a new earth" are our inheritance. But knowledge has come upon us with such leaps that we are confused and overwhelmed by its immensity and variety, and have not yet been able to comprehend and make full use of it. These new sciences and arts and laws all have their bearing, some indirectly, some most directly and vitally, upon that of public health. It will be the duty and the privilege of the sanitarians of the new epoch to sit down and calmly consider the wondrous legacy of knowledge and of fact which the last has bequeathed to it; to sift out the manifold theories which have been exploited; to assign to new discoveries and laws their true place in the scheme of preventive medicine, and thus to bring order and symmetry out of the present chaos. To attempt to glance into futurity and depict conditions of possible advance and attainment in the prevention of disease and suffering affords a tempting field for fancy and conjecture. But Richardson has already preempted this in his Utopian City of Health.

Rather bear with me for a few moments while I call to your remembrance certain epochs in sanitation in the past; periods which stand out with peculiar vividness upon the page of history, and each of which possesses its distinctive character and teaches its own lesson.

Not being provided with the paraphernalia of the stereopticon, that indispensable illustrator of the modern lecture, I propose to supply the deficiency by painting as well as my poor pen will permit, a series of word-pictures to which I shall call your attention as though displayed upon the magic screen. It is said by philosophers that every observer sees his own rainbow. The colors are vivid and entrancing or dull and disappointing exactly according to the clearness of vision or point of view of the spectator. So with my pictures, I shall expect my audience to share the responsibility of finding them clearly defined or indistinct, pleasing or tedious in accordance with their mental attitude. All that I shall claim for them is historic accuracy in general effect, if not in minutest detail. They will belong perhaps rather to the impressionist than to the pre-Raphælite school. Let me hope, at least, that I shall not commit the blunder attributed by Florian, the French writer of fables, to one of his heroes. The fable is addressed to writers who, in their efforts at grandeur of style and beauty of diction, fail to present their subject in a clear light. The story is of a monkey whose master had a magic-lantern. Jocko learned by heart the mode of manipulating the lantern and his little paws itched to try it himself. So one day, in his master's prolonged absence at the village tavern, he invited all the animals in the town to attend an exhibition for which he charged no admittance fee—I need hardly say that under

these circumstances the audience was large if not select. His introductory address was a model of eloquence and called forth hearty applause. He then with great ease of manner slipped in slide after slide, depicting the glories of the universe, including Adam and Eve in the Garden of Eden, surrounded by the ancestors of his audience, describing each scene accurately as he went on. But as the exhibition progressed, murmurs began to be heard from the benches, which finally became an uproar and brought the exhibition to a close. On comparing notes the spectators found that it was the universal experience that although they had heard many big words, they had seen absolutely nothing, and poor Jocko found to his dismay that, absorbed in his own eloquence, he had forgotten to light up his lantern. I trust none of my hearers will be so unkind as to say at the close of this address (whatever they may think) *"Mutato nomine de te fabula narratur,"* or to put it in English, "You would better not have monkeyed with the magic-lantern".

Let us suppose that while we have been indulging in this preliminary chat, our operator has introduced into the stereopticon the full blaze of this wonderful water-borne electricity, the very spirit of the cataract, and that the lights having been turned down, we are now ready for the show.

The picture which has been flashed upon the sheet depicts a vast desert hemmed in on either side by ranges of rugged mountains. Midway marches a vast host. Six hundred thousand fighting men form the vanguard and rear guard and protect the flanks. Within the serried ranks, travel in complete security the non-combatants, the priests and levites, combining the functions of ministers of religion, officials of state and health officers, the women and children, the flocks and herds. Note the magnificent bearing of these troops, all in the vigor of perfect manhood, none showing the decrepitude of age, for these are the sons of Israel, and not an individual old enough to have become tainted with Egyptian corruption in body or mind before the exodus from the land of the Pharoahs, now lives, save only the leader and legislator Moses, and the general Joshua. Their muscles hardened by a thousand marches and countermarches, battles and forays, their frames developed to the standard of perfection by constant military exercise and rigid adherence to the strictest code of personal hygiene ever conceived or enforced, is it to be wondered at that they swept over the fair fields of Palestine almost unresisted by the sensuous, diseased and enervated inhabitants of the land? That Sihon, King of the Amorites, and Og, the King of Bashan, found armies and incantations alike powerless to stay their victorious march? That they formed a dynasty whose power was felt for centuries from the Nile

to the Euphrates; and accumulated stores of wealth which made their capital the wonder of the world for beauty and magnificence? Truly the sun has never before nor since shone on so goodly an array of victorious warriors, of noble matrons ready to do their day's march with their infants on their arms, of joyous blooming maidens, of sturdy children carrying their pet lambs or milk-white kids on their sun-browned shoulders, and proudly bearing their part in the labors of the camp and the calvacade. And what is the secret of this abounding and universal health and vitality? Let us consider the question a moment while we are waiting for the next picture.

It is simply that every act of their daily lives, man, woman or child, has been regulated in accordance with that wonderful set of hygienic laws and regulations known as the Levitical Law, or the Laws of Moses. Just in proportion as any nation lives up to the requirements of that law, just so far will it become prosperous and powerful. Just so far as its people disregard them, just so fast will it fall into decay and impotence, as in fact did the Hebrew race itself. This epoch in sanitation we may style the *Hebraic* Epoch or the Era of *Personal* Sanitation.

Centuries roll by and now comes into view in stately panorama, Rome, the mistress of the world, the city of Cesars. We are looking down upon the Via Triumphalis, the street by which victorious generals are wont to enter in triumphal procession on their return from a successful campaign.

As we rest upon the steps of the beautiful temple, in which stand, side by side, with equal honors, the statues of Æsculapius, the God of Medicine, and his lovely daughter, Hygieia, the Goddess of Health, we see passing before us an imposing procession. Two lictors march with stately tread at the head of the column, bearing the fasces, the emblem of imperial power and carried only before dignitaries of the highest rank. Then follows the hero of the day in a gilded chariot, drawn by magnificent prancing steeds, and almost buried under the wreaths and flowers which the jubilant crowd have showered upon it. On either side rides an escort of mounted knights, but not in armor. Then music, a part of every procession since the pipe of Pan was first invented. After this a strangely assorted series of companies of professional men and artisans, each with an appropriate banner, all bearing the implements of their respective crafts, civil and sanitary engineers, architects, secretaries, stenographers, artificers and laborers. What is the meaning of this curious pageant, and who is this man of intelligent and noble mien, whom the populace esteem so highly and greet with such friendly acclaim? Evidently not a conqueror fresh from scenes of carnage. If we could inquire of

that little street urchin, who sits close to us, perched astride of the foot of the great statue of Minerva, he would probably reply by putting his tongue in his cheek in token of derision and asking us, after the manner of his kind, if we are farmers from way back of the Grampian Hills, that we do not know that this bully man is Sir Frontinus, the "Consul of the Waters", or as we should say, the Superintendent of the Water Department. He might also condescend to inform us that this a general holiday in Rome, because Consul Frontinus is going out to make his annual inspection of the "Virgin", the most beautiful and copious of all the twenty great aqueducts, which bring water to the city from mountains sixty miles away, supplying for each inhabitant, man, woman and child, three hundred and twenty-two gallons per day. And then he would probably conclude with a modest request for an *ass* to buy a honey-cake with. Slowly the procession pursues its way through the winding streets, ever greeted by tumultuous applause, and the picture fades from our view. Need we look farther for an explanation of the fact, that this one city was the mistress of the nations? A city in whose municipal administration the highest place was accorded to the officers of the sanitary corps. A city which not only supplied pure drinking water but baths of crystalline purity for all its citizens, a city in whose sewers vessels might sail, a city which worshipped as a divinity the sweet smiling Goddess of Health. How could this race fail to be stalwart? How could her soldiers fail to win? This epoch we shall style the *Roman,* or the Era of *Municipal* Sanitation. Well may we emulate its virtues.

Again I press the magic bulb, and while the pageant at which you have been gazing, has slowly faded from the screen and another scene has gradually made itself visible upon the canvas, centuries again lapse, and, as they pass, imperial Rome, intoxicated with power, besotted with luxury, loses her civic virtues,—the inheritance of ages of stern republicanism,—her manhood becomes debased, effeminacy and disease take the place of vigor, her public works, neglected by venal politicians, crumble to decay and she falls the easy prey of the sturdy barbarians of the North. As the lines of the picture grow stronger, you recognize that you are looking upon a court of justice. The session is held in a marble basilica, many columned, of exquisite proportions, and gay with harmonious coloring. We need wander no farther than the suburbs of the noble emporium of the lakes, in which we are now assembled, to find its counterpart in the prismatically tinted city, planted as by the wand of a magician at its very gates. It is in the city of Ravenna by the Adriatic that the noble building in our picture stands. In the dim distance the foot-hills of the Appenines covered with vine and olive and near-by forests of towering pines. But is

this a court or a barrack? Why these stands of arms, these rude soldiers, some clad in coats of mail, but more in skins, contrasting strangely with the rich togas of the Italian patricians and the soberer jerkins of the peasants and townsfolk? And, above all, why is the dispenser of justice, seated on the marble bench, clad from head to foot in glittering armor and not in judicial robes? Look well on this noble face, this towering form, for his is "one of the few, the immortal names that were not born to die," Theodoric the Great, Theodoric the Ostrogoth, Theodoric the barbarian champion of civilization. (In the church of the Franciscans at Innsbruck you may see his statue.) All Italy is now at his feet. The last of the "Shadow Emperors" of Rome has laid down his arms, and the conqueror is taking his first step in reforming the abuses of this unhappy country. The first culprit who is brought to the bar of justice is an inn keeper, and the complainant is a traveler who swears that although he had ordered and paid for pure water with his dinner, this rascally landlord had diluted the water with wine in order to conceal its vileness and impurity. There being no defense the offender is sternly reprimanded and sent to jail. But this is evidently only the prelude to a weightier case. "Bring the town council to the bar" commands the Emperor in tones of thunder; and forthwith, between double files of soldiers, with manacles on their wrists, the City Fathers march up the broad aisle, some with heads bowed in shame, but the most with that air of brazen effrontery which stamps the mercenary politician who is "in it" simply for what it is worth. A hush falls over the vast assemblage, for when has such a procedure been witnessed before in council-ridden Ravenna! The Emperor's voice commands: "Lord Secretary of State, read the indictment." In tones which are distinctly heard all over the vast hall, the indictment is read, setting forth at large and with all the usual legal verbiage, that whereas the people of this good city of Ravenna were for generations supplied with pure and wholesome water brought fresh and sparkling from the distant Appenines in massive aqueducts; and whereas, the city was once provided with a thorough system of drainage and sewerage thus rendering Ravenna famous for its salubrity, now, owing to the neglect of the council, the aqueducts have been allowed to fall into ruin and the drains to become clogged. The monies which would have been devoted to keeping the water works, pumps and reservoirs in repair, and preserving the integrity of the drainage system, have been diverted into channels which it were a shame for him, the Secretary of the State, to mention. So that it had become a well known proverb that, as has been demonstrated by the case which has just been tried, "Water fit to drink is dearer than wine in Ravenna"; and the beautiful meadows which once

surrounded the city have been converted into pestilential swamps. Much sickness and many deaths have resulted from these causes, the fair fame of the city has been sullied, and its trade and commerce greatly diminished. The indictment then quoted from the report of the sanitary engineers who had been commissioned by Theodoric to make a tour of inspection of the public works, showing how great the neglect had been, where, and to what extent repairs are needed, and how they should be made. "These recommendations have been carried out" it continued, and I quote the exact words, "we shall again have baths that we may look upon with pleasure, water which will cleanse not stain; water, after using which, we shall not require at once, to wash ourselves again; drinking water, the mere sight of which will not take away our appetities." The indictment concludes with a petition for relief and for the removal of the unfaithful officials. Majestically, and with awful scorn upon his face, the monarch rises to pass sentence. In scathing terms he depicts the crime of which the members of the council have been guilty in poisoning the people with impure water in order that they might enrich themselves. In tones of righteous indignation he orders their robes of office to be stripped from them and sentences them to hard labor on the public roads,—roads which remain to this day to witness his wisdom. The prisoners having been removed, the "Counts of the Aqueducts" of Ravenna, Rome and Verona are now summoned before the presence of the Conqueror and Judge. Noble men are they, noble in birth, and noble in mien. They are admonished that while, in the past their duties have apparently not been adequately discharged simply owing to the failure of those in charge of the public funds to provide the means which they have asked for, in future no delinquencies will be overlooked. They are urged to display their zeal for the public good by personal attention to the greatly needed repairs of the water works of all these great cities, and by constant supervision of this important department of city government. His acute mind descends to the smallest details. He calls their attention to the fact that weeds and small trees taking root in the crevices of the aqueducts dislodge the stones and weaken the piers, and instructs them to make it the duty of all farmers through whose land the aqueducts pass to keep them free from these growths, under heavy penalty. But his voice suddenly waxes vehement and his brow stern as he warns them against connivance at the frauds which have so often marked the management and distribution of water supplies. In conclusion he assures them kindly that the strengthening and preservation of the aqueducts will constitute their best claim on the favor of their sovereign. Slowly and thoughtfully the great assemblage disperses, but the lesson of the day

goes on. A new epoch in sanitation has commenced. We may call it *Gothic* from the nation whose characteristics were exemplified in the person of their great leader who inaugurated it, or the Era of *National* Sanitation, as it placed the protection of the public health entirely under the control of the central government, and recognized the great truth, later enunciated by one of England's most astute prime ministers, that "the health of the people is the first duty of the statesman." For an entire generation this great and noble barbarian, this sagacious sanitarian, ruled a united Italy with unquestionable justice and wise forethought, his enemies even being the judges. Trade was encouraged, manufactures developed, education fostered, and the public health safeguarded. For centuries the benefit of his rule were felt in Southern Europe. Nearly a millenium and a half have rolled by since the scene at which we have been gazing was enacted, and yet Theodoric's tomb is still shown the traveler outside the walls of Ravenna, and his name is revered by her people. But where are the tombs of the City Fathers? While waiting for the next picture to appear upon the screen may we not pause a moment to congratulate ourselves that we live at an age and in a country in which councilmanic corruption is a thing of the past, in which frauds are unknown in connection with water supplies, and in which no city in all the broad land is without an abundant supply of pure, crystalline and wholesome water? Or do I catch a murmur of dissent, and a low-breathed prayer, "Oh! for a Theodoric!"

And yet, history, cycling round these fifteen hundred years, has in a wonderful way repeated herself, and furnished us a modern Theodoric, in the guise, not of an individual, but of a nation. Two pictures will be needed to bring this hero before your mind's eye. If the operator will focus a little more distinctly we shall be better able to see the first.

Again a magnificent city, its palaces glittering under the rays of a semi-tropical summer sun, its beautiful, land-locked harbor guarded by frowning castle and bristling fortress, its port full of vessels, all riding at anchor, brilliant with the colors of their respective nations. Truly a fair city, truly an inspiring sight! But beautiful as it is, I shall not dare to ask you to accompany me ashore. For there would you see sights unutterable, scenes indescribable, filth uninimaginable. Smallpox would grin at you on the public streets. Leprous hands would be stretched over your very table craving alms. The victims of yellow fever would be carried by you to the overflowing hospitals, or black-robed, black-masked "brothers" would be bearing them to crowded graves. No, this is no place for you to linger in, for famine

and pestilence here hold carnival, while foreign soldiers dance and make merry. The very waters over which your skiff would glide to reach the marble wharves, filth-laden and murky, give forth a horrid stench. More than a decade ago, a member of this Association, who had witnessed something of these horrors, was moved to present a paper descriptive of them, and to declare that so long as the Spanish power held Cuba in its grasp, this beautiful city of Havana would constitute a horrid menace to the health and happiness of many countries, notably our own; and that, if force were necessary to bring this appalling condition to an end, force would be justifiable and must be resorted to. The interval between this picture and the next, which must be our last, is measured by months, not centuries. But how pregnant is it with events. A nation profoundly devoted to the arts of peace, "but a youth" among the nations, has thrown down the gage to a nation of soldiers, "a man-of-war from his youth," has demanded that these and other enormities shall cease; and amid the gibes of old-world powers has calmly prepared to enforce its demand. No need for me to throw upon the screen delineations of that fateful May-day in Manila Bay, or of that third of July off Santiago, or of the impetuous rush of khaki and blue-coat up San Juan Hill, which ushered in the birth of a new republic into the family of nations. These are indelibly painted on the mental retina of every one of you. But I will ask your attention to the picture now developing. What! do you say that I am showing you the same picture over again? True, there are the same glittering palaces, the same lofty towers, the same hills and groves; but the water is now clear and sparkling, and flying fish spread their rainbow wings where erst was only death and stagnation. You need have no fear now of going ashore with me. Your senses will no longer be shocked. Your lives will no more be in danger.

A practical sanitarian who has enjoyed the advantage of residence for a considerable time in the island of Cuba, testifies that in the short space of two years the United States has succeeded in completely reclaiming Cuba from a sanitary standpoint; in transforming it from a place reeking with pests, disease, epidemics, contagion, into a thoroughly habitable and healthy community. "There is no question" he writes, "that this has been done." No matter how radical differences of opinion regarding the principles involved in the temporary American control of Cuba, there has been no dissenting voice to the proposition that the brief period of the United States occupation has brought about the achievement of sanitary reforms so great that the neglect of centuries has been repaired and the island benefited to an incalculable degree.

Streets, alleys, purlieus, suburbs, public buildings, private residences, have been cleaned and improved; streets have been repaired and repaved; epidemics have been either materially curtailed or completely abolished; for the first time in Cuban history the dread ravages of yellow fever have been checked. The death rate in crowded Havana has been reduced from sixty-seven per thousand to twenty-five per thousand, and is being still further reduced. The decrease of deaths from yellow fever is still more surprising. Formerly the monthly average in Havana alone was one hundred and three deaths. I do not believe that the rate for the whole island now exceeds this figure. The article from which quotation has been made, was penned during the early part of the present year; and, before midsummer, it was possible for the surgeons of the United States Marine Hospital, in charge of the station at Havana, to telegraph that not a single case of yellow fever had developed in that city for two weeks, and to suggest the possibility of modifying the quarantine regulations of United States ports in accordance with that astounding fact.

Thus brilliantly is the last epoch closed. In view of the fact that patient investigators on both sides of the Atlantic have combined to mine out the rich nuggets of knowledge which have made the sanitary regeneration of the great city possible in so brief a space of time, and as these investigations have been principally conducted within the last century, it will be appropriate to denominate this epoch the *Americo-European* or the Era of *International* Sanitation.

Thus auspiciously is the new epoch inaugurated. What will be the characteristics of this epoch and by what name shall we designate it? Is seems to me that our pictures will give us the clue. It will be the sanitation of *absolutism* and of *precision.* This power will know no geographical limit, and will recognize no diversity of political organization. Wherever a centre of contagion lurks on the face of this globe, there the sanitary authority will seek it out and destroy it. Whether in the heart of China, in the frozen steppes of Tartary, under the scorching sun of tropics, or in the isles of the sea; whether Emperor, Dictator, King, or President, govern the land, sanitary law will be paramount to all other rule. *Vi et armis* will this be accomplished, if force of arms be necessary but rarely will a resort to this dread abitrament be needed, unless indeed hoary superstition shall persist in maintaining shrines which have from time to time sent forth a wave of pestilence over the whole face of the earth. Should a sanitary crusade ever become a necessity, for the protection of civilized nations, it will have no such fatuous and futile ending as have marked the religious crusades of history. Of this let the Moslem take note.

This world-wide *absolutism* of sanitation, its first characteristic, will have its justification in its second characteristic, *precision.* The results of the two great sea fights by which the map of the world has been recently changed were made possible by the use of what our French brethren call "arms of precision," in the hands of men trained to use them.

The most miraculous achievements of modern surgery are made possible by the employment of instruments and methods of "precision." And in the same way sanitary science has, within a comparatively brief time, become possessed of instruments and methods of precision. We no longer talk vaguely of cosmic perturbations, aerial influences, noxious miasms and epidemic constitutions of the atmosphere, but have exact and definite knowledge of the characteristics, habits and life-story of nearly all of the organisms which are the cause of contagion.

We no longer build great fires and beat tom-toms and charge upon the foe with disinfectant blunderbusses and stink-pots, but, by bacterial analysis and microscopic investigation, determine the precise nature of the enemy, and attack him with the germicide most inimical to his life, as nearly as possible at the point of his origin and development.

It is this that gives us the right to insist that the knowledge which we possess shall be shared and taken advantage of by all the peoples of the earth; so that, local epidemics may be stamped out at the place of their birth, the annoyances, vexations, and losses incident to maritime quarantine may become things of the past, and widespread pestilences be no more known upon the earth. This will constitute the *Universal* epoch, the Era of the World's Sanitation of Absolutism and Precision.

ADDRESS OF WELCOME.

By ANSLEY WILCOX, Buffalo, N. Y.

Under the shadow of an awful calamity, which has pierced through the heart of this community and spread instantly over the nation and the civilized world, we are called upon to welcome to the city of Buffalo the members of the American Public Health Association. Our mayor, an honored member of your profession, is following the mortal remains of the late President to their last resting place, and I am suddenly required to express, however inadequately, the sentiments which fill our hearts as you enter this house of mourning.

It is well that the serious duties of life call us away from too protracted brooding over such affliction. Men like yourselves, who must work, to whom the world looks for the performance of daily and hourly duties needed for its protection and advancement, while they must stop their ordinary avocations long enough to pay their tribute of respect to the departed and to share in the national sorrow, must also turn back soon to face the stern necessities of their daily duties and their allotted public and private tasks. Pleasure-seeking and merrymaking at such a time are far from the hearts of every one. And so it is, as you have been apprised, that all forms of entertainment which were prepared to give you special pleasure during your convention here have been abandoned by unanimous consent. But the serious work of this convention must go forward, and the friends and fellow-laborers who meet here will feel their hearts and their minds sanctified to their tasks and inspired to purer and better achievements by the fiery trial through which we have all been passing.

Indeed there is something peculiarly fitting in a meeting of minds devoted to the protection and advancement of the public health at a time like the present. It is the public health and the public welfare to which your attention will be devoted,—it is the public health and the public welfare which has just received so severe a blow. Wherever large bodies of men are gathered together in a community, their mere contiguity creates a necessity for certain precautions to protect them from evil influences emanating from one another, either voluntary or involuntary. These influences, of course, may be physical, affecting the bodily health, or mental, affecting in other and even more subtle ways the well-being of mankind. This necessity is the basis of all government, and you, gentlemen, in your discussions here, will be

shedding light upon one and a most important branch of our present governmental obligations.

The greatest problems which the American people have to face to-day are those connected with the government of cities, and close at the roots of all these problems lie questions connected with public sanitation. The protection from contamination and disease of large bodies of people closely associated together in cities is always a complicated and difficult task, but difficult as it is in our own cities, this people has now to face a new and greater responsibility forced upon us by the acquisition of tropical islands where people of alien and mixed races are gathered together in masses under conditions which formerly made them hotbeds of the most virulent diseases. Whether this responsibility was welcome to us or not, it is now upon us, and must be faced manfully and with radical corrective measures. This work has been begun and so far prosecuted most successfully in Havana and Santiago and Porto Rico under the efficient management of representatives of our government, and we all believe that it will be prosecuted with equal success in Manila and the other large cities of our new tropical possessions. It is your duty and your privilege to point out the way.

And here I am led to stop for a moment to pay a tribute of affection and respect to my dear friend and your former leader as well as friend, Col. George Waring, who fell a victim to the former disease-breeding conditions of Havana, where he was laboring to blaze out the path of effective reform in public sanitation. He fell, but not, I am glad to believe until he had substantially completed his great work as a pioneer. He was as truly a martyr to the welfare of his country and of mankind as was Lincoln or Garfield or our latest martyr, McKinley.

Gentlemen, we welcome you with all our hearts to the city of Buffalo, where public sanitation has been studied under the leadership of skilful and scientific minds, and happily free for some time past from the blinding influences of partisanship inspired by self-seeking or party politics. We are proud of our beautiful city for many things, but for none more than because its streets are clean, its water supply is abundant and good, its sewerage system has been wisely planned, and in the main has been well carried out, (and again I bow here to the name of Col. George Waring, who suggested and carried through our principal intercepting sewer), its ashes and garbage are well removed and well cared for, its death rate I believe is among the lowest, if not the lowest, in this country, and that means in the world. Lest it be said that in this catalogue of our virtues we are assuming too much, I immediately add that in all of these respects we are conscious still of

grave shortcomings. We are not satisfied with our achievements, but are working forward to still better ends.

We are proud too of our Pan-American Exposition, of its beauty and of its instructiveness. And among other features of the Exposition we place high its healthfulness, and, so far, the blessed avoidance of all of those dangers of disease which necessarily accompany the gathering together of such large masses.

Our local representatives will take delight in showing you these things, and in learning from your experience how to improve upon them.

And when you visit our Exposition first at night, and see its loveliness emerge from the early darkness with a gradual glow of splendor, as the electrical illumination begins, and as you face that beautiful pinnacled tower, quivering with light at every point, which look down upon the Temple of Music where our President was shot down by the assassin, you will feel, I know, that you stand before a shrine, where all that is good and beautiful in the hearts and minds of this nation has produced its best results,—a shrine which ought to be, and will be, visited during the few brief weeks of its remaining existence by all of the American people, rich and poor alike, with feelings of reverence and awe for the achievement which it represents and for the good man, our national leader, who fell at its feet. You will think of his unwilling successor, still throbbing with the energy and fearlessness of youth, but serious and conservative through experience and the growing wisdom of advancing years, whose honest, manly heart, heavily laden with new cares, is now following the body of his former chief from Washington to Canton, and you will say "God bless him, may his achievements be equal to his high purposes!"

And then, when you look again upon that vibrant tower of light, and think of the tragedy which was enacted at its feet, and of the way in which the American people calmed themselves in their intense grief, and the reins of power dropping from lifeless hands were taken up peacefully by the strong hands of the appointed successor, with no dissension and no change of the great national policies which the people had approved, you will say again with heartfelt joy, "Whatever may happen to our individual leaders, the government at Washington still lives, and in spite of defects and shortcomings, it towers among the nations of the earth, shedding brilliant and steadfast light, as our electric tower does amidst the beautiful buildings which surround it."

RESPONSE OF THE PRESIDENT TO THE ADDRESS OF WELCOME.

By BENJAMIN LEE, M. D.

Mr. Chairman, and Members of the American Public Health Association, Ladies and Gentlemen—I should be false to my own instincts, and I am sure to yours as well, did I permit my first utterance on this occasion to be aught else than an expression of the overwhelming sorrow into which we have been plunged by the sudden and tragical death of the beloved and revered chief magistrate of one of the nations here represented. I do not permit myself to doubt that the delegates from the other countries share with those of us who have lost our President, this sense of profound grief with which our hearts are rent and our heads are bowed, and of keen disappointment that a career so noble and so useful should have been thus abruptly cut short by the bullet of the assassin. Indeed, the spontaneous tribute of sympathy and of eulogy conveyed in such eloquent and feeling language to which we this morning listened from the mouths of the representatives of the Dominion of Canada and the Republic of Mexico absolutely forbid such a thought. Our consolation is that, in death as in life, he bore himself nobly as a patriot, a Christian and a gentleman, leaving an unsullied name as a legacy to his countrymen.

Among the many difficult problems with which this Association has had to deal, is that of the proper care of the leper. But there is a moral leprosy which is a far greater danger to national life than physical leprosy. The anarchist is a moral leper. The proposal has been made that the lepers in such of the West India Islands as the United States controls, should be placed in an asylum on the Isle of Pines. I venture to offer the suggestion that this island might be divided into two districts, one reserved for the humane care and treatment of the unfortunates afflicted with physical leprosy, while to the other should be deported with as little delay as may be practicable, all those attainted with this moral leprosy, all anarchists, and all those who encourage anarchism, whether in publications or by word of mouth; that they should be forbidden under pain of death from establishing there any form of government whatsoever, but should be left, untrammeled by law, to practice their vile art of assassination upon each other. This moral leprosy has shown itself to be vastly more contagious than physical leprosy, and no time is to be lost if the spread of this most horrid of all infections is to be checked.

To you, Mr. Wilcox, as representing his Honor the Mayor of Buffalo, and to the citizens of this beautiful metropolis of the lake, whose welcome you have so kindly and in such fitting language extended to us, permit me to offer in return the thanks of the Association for this act of courtesy. We rejoice to be able to share with you in your rejoicing over the fact that you have completed your first century. To me, as a representative of Pennsylvania, if a personal allusion may be pardoned, it is a matter of no little pride that Buffalo was discovered by a Pennsylvanian. When I reflect that it is but a scant hundred years since that stalwart republican from Bucks County, Joseph Ellicott, and the charming Mrs. Brisbane cantered side by side under the lofty trees which then covered the site of this now populous community, and he, with that superb daring which has ever characterized the Pennsylvania pioneer, with one bold stroke, appropriated at the same time, the virgin forest and a heart which if not virgin, was still full of generous and affectionate impulses, which responded not unkindly to his ardent suit, and when I remember that in an encyclopedia published in Philadelphia nearly twenty years later no mention is made of the town of Buffalo, I am filled with amazement at the immensity, the opulence and the magnificence of your city.

Your chief claim to our admiration, however, lies in the fact that you are fully alive to the importance of strict attention to the requirements of sanitary law, in order that your high standard of health, and hence your prosperity may be maintained. To this fact the cleanliness of your beautiful streets and stately avenues bears witness to the most superficial observer, while your low death-rate offers the same testimony to the student of vital statistics.

While we may learn much from you, we trust that this meeting will support the arms of your efficient health commissioner, and lead to still further improvement in your admirable system of sanitary administration.

ON THE PROGRESS OF PUBLIC HEALTH ORGANIZATIONS IN THE UNITED STATES.[1]

By STEPHEN SMITH, M. D., LL.D.,

First President of the Association.

Mr. President and Members of the Association—I esteem it a great privilege to be permitted to attend the first meeting of the American Public Health Association in the Twentieth Century. Since its inception a period of about thirty years has elapsed which in the ancient mortuary statistics indicates that a generation of the human family has passed across the stage of life. When your honored president, my long-time friend, intimated to me that it would be appropriate on this occasion to have some words of greeting, counsel and encouragement from those who were active in the organization of the Association, I examined the list of first members to determine who could most acceptably perform that duty. It was painful to notice the havoc which death had made in our ranks in a generation. Elisha Harris, Edwin M. Snow, John H. Rauch, Ezra M. Hunt, Charles B. White, James E. Reeves, Henry I. Bowditch, James L. Cabell, Joseph M. Toner are historic names in the annals of sanitary reform in this country. On this review I am constrained to announce in the language of the messengers who came to the patriarch Job, in his afflictions and said, "I only am escaped alone to tell thee."

The chief or immediate object which the first promoters of the Association had in view was by organized effort to unify the work of those actively engaged in the administration of public health laws and to nationalize sanitary authority in Municipal, State and National Governments. At that period the foundations of our national system of sanitation of cities and villages had but recently been perfected in the establishment of the Metropolitan Board of Health of New York, on a sanitary law largely English in its origin. For this law the country is indebted to the late Hon. Dorman B. Eaton, an early and active member of this Association. It formed the basis of the subsequent health legislaton of the different states, and may justly be considered the most perfect code of sanitary law that has yet been placed on the statute books. Competent health organizations then existed only in a few cities, notably in Chicago, Washington, Boston and New

[1] An address before the American Public Health Association, at Buffalo, New York.

Orleans. But even these health boards, with the exception of the Metropolitan of New York, were feeble compared with those now filling their places. The agitation, however, in favor of stringent health laws and their efficient enforcement was becoming more and more intense in all parts of the country and it was apparent that there should be combined action on the part of all the workers in this new field of reform. To secure the co-operation of all the forces and influences tending to enforce sanitary legislation throughout the country this Association was projected. It required scarcely more than the suggestion that such an organization was essential to the reform movement to bring into active sympathy and cordial co-operation the constituent members of the Association and at once the organization was perfected.

The growth of public health administration in this country under the fostering care of the Association has even exceeded the most sanguine anticipations of its founders. Thirty years ago there were not more than three or four well organized Municipal Boards of Health in this country, but to-day there is scarcely a community having a civil organization that has not as an integral part of its government a public health department. State Boards of Health were almost unknown at that period but now they exist in nearly every state and by their good work commend themselves to the confidence and support of the people.

At the first meeting of the Association the initial step was taken to create a Central Sanitary Authority in connection with the General Government, but it was nearly ten years later and only in the immediate presence of a wide-spread and fatal epidemic of yellow fever that a National Board of Health was organized. Thus, within a single decade, this Association had been largely instrumental in the development of a complete system of public health administration in this country, viz, municipal, state and national. Unfortunately the law which gave the National Board of Health its powers and financial support continued in force but four years and at the end of that period Congress refused to reenact it. The result was that the Board practically ceased to exist at the end of that period. It is now upwards of twenty years since the National Board of Health was deprived of its powers and during that period our national system, as originally devised by the members of this Association, has remained incomplete.

The advice which I think the constituent members of the Association would give you at this first meeting of the century would be to remedy this defect in our national sanitary system at the earliest practicable period. Our government, whose jurisdiction now extends over peoples of every grade of civilization, living under every variety of climatic conditions, requires a Central Sanitary Authority competent to

answer wisely, and in conformity with the latest teachings of science, the multiform questions relating to the public health of this heterogeneous population which must from time to time be determined in its councils. The failure hitherto to secure from Congress such legislation as would give the country a proper public health organization at Washington are largely due to the want of harmony of opinions of those who have sought such legislation, and the opposition of the Marine Hospital Service, which very naturally desires to retain its position. The want of harmony arises from the fact that comparatively few of those who approach Congress on this subject are competent to form a correct opinion as to the nature and character of the public health service which the Government requires. This Association alone is qualified to pass judgment upon a bill to organize that service and should assume the duty and aggressively persevere until it accomplishes its object.

It is a fact not generally known that some of the first members of the Association regarded the Marine Hospital Service as well adapted to become the future Public Health Department and endeavored to promote its advancement to that position. It may interest the present members if I refer to that early history, and possibly these facts may be useful in your deliberations.

At the close of the Civil War the Marine Hospital Service had practically ceased to have any useful duties to perform, and one Secretary of the Treasury had urged Congress to abolish it. Originally created at the close of the eighteenth century, in imitation of the English system of caring for her sailor, a man before the mast, its functions in a great measure ceased when the steamship supplanted the sailing vessel in ocean and river transportation. In the former vessel the sailor's home was on the sea and his government cared for him when sick or disabled; in the latter vessel he had his own home at the port and cared for himself.

At this critical period in the history of the Marine Hospital Service, when, technically, there were but few sailors requiring government care, and a Secretary of the Treasury had advised the abolition of the Bureau, Dr. John M. Woodworth, late a surgeon of volunteers, was appointed its chief officer or Supervising Surgeon General. Dr. Woodworth was a man of culture, of polished manners, a good organizer and an enthusiastic student of sanitary science, as then understood. He was an early and active member of this Association.

In discussing with him the future of the Marine Hospital Service, I urged the importance of first assuming as far as possible, all the duties connected with the "quarantines of the United States, which grow out of the powers exercised by the Secretary of the Treasury

over the customs. If he should succeed in demonstrating the value of medical authority in determining incidental health questions arising in the management of quarantines under local administration, the tendency of the Department would be to give the Marine Hospital Service jurisdiction over all similar questions. Meantime additional legislation might enlarge its powers and duties in the management of quarantines, until it might attain, first, to a supervisory and, finally, to an absolute administration of their affairs. Advancing along these lines, without any other rival in the field, the Marine Hospital Service would naturally assume more and more the position of a central authority on all questions relating to the public health which come under the cognizance of the General Government. Thus, the Bureau might in time become, if not a Health Department, at least the permanent branch of the government service devoted to public hygiene."

Dr. Woodworth acted on the suggestion and until his death in 1879, steadily pursued the policy of making the Marine Hospital Service the central authority in the control of the quarantines of the United States. His first act was an official examination as to the condition and efficiency of all the quarantines under the direction of the Secretary of the Treasury. This investigation extended to ports where either no quarantines existed or only some unexecuted municipal regulations governed the entrance and exit of vessels. The result of this inquiry was an act empowering the Secretary to make additional rules and regulations for quarantines, which were defective and require their enforcement. In case of failure in compliance by the local authorities, the Secretary was authorized to proceed to put the new rules into operation. In addition to these extraordinary powers conferred by Congress on the Treasury Department, the law provided that the Secretary should establish and maintain, under his exclusive control and management, quarantines at ports where none existed but where, in the opinion of the Secretary, the public health required the enforcement of quarantine regulations. The execution of this law naturally devolved upon the Marine Hospital Service, and aggressive action was immediately taken to secure its benefits. Lax and inefficient quarantines were rendered effective, and new quarantines were established at many unprotected ports. This was a decisive step in the direction of placing the quarantines of the country under the exclusive control of the Federal Government. The result of this legislation was of the first importance to the sanitary interests of the country, and gave a permanent position to the Marine Hospital Service.

In 1878 there was much alarm over the matter of the admission of rags from foreign ports, and the President, by virtue of the power given him by the previous quarantine law, authorized the Secretary

of the Treasury to make rules governing the quarantines in their reception of this article. Dr. Woodworth gave me the original order, prepared and signed by President Hayes, remarking, "This is a historial document which begins a new era in the history of the Marine Hospital Service."

Later in the same year occurred the great yellow fever epidemic and circumstances greatly favored the Marine Hospital Service, for it became, not only the center of information in regard to the daily progress of the pestilence, but the medium of distribution of the charitable funds and supplies to the stricken Southern communities.

Another event of much importance was the appointment of a Commission to investigate the facts in regard to the outbreak of yellow fever by visiting the localities where it had prevailed. This was due to the suggestion of Mrs. Elizabeth Thompson, a wealthy philanthropic lady of New York, who proposed to me to give liberally to a fund for the employment of a competent body of experts. I immediately communicated with Surgeon-General Woodworth, and urged him to accept the offer, appoint the Commission and be responsible for its work. He replied favorably, the money was contributed by Mrs. Thompson and others, the Commission was appointed by Dr. Woodworth and was composed of Southern physicians of large experience in the treatment of yellow fever. The investigation proceeded during the autumn months.

The epidemic of that year proved to be a national calamity and aroused a popular interest in methods of prevention hitherto unknown. Sanitary authcrities in all parts of the country were appealed to for advice and assistance, especially with reference to the proper measures to prevent the return of the pestilence in the following year. The only body competent to answer that question was the American Public Health Association. Its officers decided to call the annual meeting in Richmond, Virginia, and devote the session especially to the late epidemic. Surgeon-General Woodworth consented to present the results of the commission's work as a basis of discussion.

It became evident long before the meeting of the Association that whatever might be the special views in regard to preventive measures, the question which would dominate the Association would be: "What form of health organization shall be created in the General Government to meet the exigency of a recurrence of the epidemic in the following year?" All great advances in health legislation result from the devastations of epidemic pestilences. It is only under the stress and strain of an epidemic that has destroyed thousands of lives, wasted millions of dollars and created universal terror, that adequate public health laws can be enacted and effective administrative organizations can be estab-

lished. The yellow fever epidemic of 1878-79 had this effect and it became the earnest effort of the members of this Association to improve the opportunity to the best advantage.

The excellent work performed by the Marine Hospital Service naturally placed it in a most favorable position before the public and its friends endeavored to formulate a bill which would commend itself to Congress and would make that Service the future national sanitary authority. In conference with Dr. Woodworth, we determined that a bill creating a Department of Public Health, on the same basis as the Department of Agriculture, would be in accordance with previous legislation, and thereby meet with less opposition. Such a bill was to provide for a bureau devoted to the duties of the Marine Hospital Service and other bureaus having the quarantine and public health services in charge. I drafted such a bill, and it was introduced in the Senate at the opening of the session by Senator Lamar, of Mississippi. Like many other bills before Congress, designed to create a public health service, it met with opposition from other departments at Washington, jealous of the growing power and popularity of the Marine Hospital Service. Though this opposition had been apparent for years at the annual meetings of the Association, it did not take active form until the meeting occurred at Richmond. There it became so obstructive that no practical results were reached by the Association. At the ensuing session of Congress the same opposition was an organized force that resisted every form of legislation which might, in any manner, favor the advancement of the Marine Hospital Service. The result was the passage of a bill on the last day of the session, creating a mere skeleton of a Board of Health, with no power whatever, for either good or evil. When the people of the affected districts of the South, learned that Congress adjourned without providing any safe-guards against the return of the epidemic, the greatest indignation was manifested. In some districts, it was reported, the members of Congress were threatened with violence, if they returned without affording adequate relief to their threatened danger. Fortunately, an extra session of Congress was called, and the Southern members were only too happy to have the opportunity to pass a supplementary bill clothing the Board with suitable powers. This act, however, was limited in its operations to four years. During this period the Board faithfully performed all the duties imposed by law, and sought to organize a system of national quarantine administration and interstate sanitary supervision of commerce and travel, in harmony with the most advanced views of authorities. But with the lapse of the supplementary law, and in the absence of any impending epidemic, the Secretary of the Treasury conferred upon the Marine Hospital

Service the power to expend the funds formerly appropriated to the National Board, thus bringing that bureau prominently forward to the position it formerly occupied, but with the added powers exercised by the latter body. From time to time Congress has increased its quarantine and public health duties and added to its equipment. It now has its own buildings, like a Department of Government, with laboratories where the most accurate studies are made into the causes of contagious and infectious diseases, into the value of different disinfectants and vaccines, and where antitoxic serums are manufactured and distributed. It has a large and highly qualified staff of medical officers, appointed by the President, after competitive examination; it maintains in foreign ports, where epidemic diseases prevail, medical officers who give constant information to home quarantines and issue bills of health to vessels bound to the United States; it has under its own supervision a large number of insular and interstate quarantines; finally, it is ready at any moment, to aid state and municipal sanitary organizations in their efforts to suppress epidemic diseases.

It appears from this review that for a period of upwards of thirty years the Marine Hospital Service has steadily advanced in the direction of becoming the Department of Public Health in the General Government until it requires little more than an adjustment of its organization to the new career upon which it would enter to fulfill every requirment of that position. As the original promoters of this Association gave the first impulse to the Marine Hospital Service along the lines of development which would place it at the head of our national sanitary system, and as it has advanced along those lines until it is prepared to assume the rank and title and perform the duties of our central sanitary authority, I may be permitted to suggest that this Association should recognize these historical facts and the present situation of our public health service, and unless there are conditions not apparent to the public, begin the new century by inaugurating the Marine Hospital Service as such authority. The efforts that have been made in the past to secure from Congress legislation creating some other form of health organization have proved futile and the future promises much less success, owing to the constant advance of the Marine Hospital Service in public and Congressional favor. If I understand the objections to that Service on the part of those seeking a better form of organization it is chiefly that the public health authorities of the country have no part in its councils. It would not be difficult in my opinion, to remedy these and other defects, if this Association exercised its friendly offices with the chief officer of that service in securing necessary legislation. These suggestions are submitted with much diffidence to the better judgment of the Association.

MR. PRESIDENT: It would ill become me to attempt to detail to the members of this Association the contributions of sanitary knowledge and experience by the last half of the nineteenth to the first half of the twentieth century. It is sufficient to state that, through the labors of its Pasteur, the mysterious realm of the causation of epidemic diseases has been thoroughly explored and the nature of their causes have been made known; through the labors of its Koch the life-history of these causes have been accurately determined; through the experiments of its Lister the agencies which destroy these causes and arrest their destructive processes have been placed in the hands of every human being. The century closed with the warfare of man against the multiform and manifold causes of disease, which beset him on every hand, in the flood-tide of success. If that warfare is pressed as vigorously during the twentieth century, as it has been in the last decade of the nineteenth century, it will require no great stretch of the imagination to anticipate that long before this century closes, the whole brood of pestilential or communicable diseases will be exterminated from the earth, and man will reach his normal period of life—*one hundred years.*

REPORT OF COMMITTEE ON TRANSPORTATION OF DISEASED TISSUE BY MAIL.

An informal meeting of those members of the committee who were present was held during the annual meeting of the Association at Indianapolis, Oct. 22-26, 1900. In discussion it was suggested that each member of the committee be asked to prepare and forward to the chairman, specifications and plans or actual sample cases, etc., which seemed suitable for the safe transportation of various diseased tissues through the mails. In accordance with this suggetion a circular letter was sent to each member of the committee on Dec. 17th, 1900. With this was enclosed a copy of the report of the committee which had served for the period 1899-1900, which had not yet been printed. The circular letter was in substance as follows:

"The enclosed report of last year's committee indicates some of the difficulties to be met. In it, you will find the present U. S. postal regulations quoted.[1] Reference to them shows that the efforts of the Colorado State Board of Health have been successful in securing permission to employ a test tube of greater length (five inches) for the transmission of dry specimens, with a corresponding increase in the size of the outer cases, and this package is now treated as letter mail. Dr. Tyler, secretary of the Colorado State Board of Health, has promised to send to each member of the committee a sample outfit for the transmission of diphtheria specimens (swabs) with directions for use, etc. This outfit is presumably acceptable to the U. S. postal authorities under the present regulations, although it does not appear to comply in all respects with the specifications.

It must be borne in mind that it was only after very great effort and a huge expenditure of time and energy on the part of the committee first appointed by this Association[2] that permission was obtained to use the U. S. mails under the conditions outlined in Order No. 88, dated Feb. 5th, 1896, and Order No. 677, dated Dec. 27th, 1897.

The efforts of the present committee should be directed towards the maintenance of all necessary precautions whilst making the use of the mailing case applicable to the needs of all. To ensure this, a knowledge of the requirements of the laboratories in the three countries represented in the American Public Health Association is necessary in order to obtain the adoption of uniform regulations. With these

[1] Order of Postmaster General No. 176, dated March 2d, 1900, and the amendment thereto, dated May 28, 1900.

[2] See Journal of the American Public Health Association, October, 1897, and October, 1898.

matters clearly in view, it seemed wise to those members of the committee who were in attendance at the meeting in Indianapolis, that each member should be asked to prepare and forward to the chairman, specifications and plans or actual sample outfits at an early date (not later than March 1st, 1901). If the same form of outfit cannot be made available for universal use, please give your views in detail, upon the forwarding of the following materials:

1. *Cultures of Bacteria.* Should these be hermetically sealed? What should be the nature of the culture medium employed, etc.?

2. *Diphtheria Specimens.* Should they be sent on swabs or should cultures be inoculated by physicians at the bedside? Is it desirable to return both swab and culture? Is it desirable to send both nose and throat specimens?

3. *Specimens of Blood for Widal Reaction.* Should these be regarded as "diseased tissue"? If so, how should they be packed? If no danger attends the forwarding of such specimens, it would seem well that they be definitely excluded from the general group of "diseased tissues."

4. *Specimens of Blood from Malaria Patients.* Should these be regarded as "diseased tissues?" If so, how should they be packed, etc.?

5. *Sputum.* How should this be sent?

6. *Blood, Pus, Exudate, Faeces, Urine, Etc.,* from such forms of infection as anthrax, cholera, typhoid, glanders, etc.

7. *Pieces of Tissue* for pathological examination, either fresh or preserved in alcohol, formalin, corrosive sublimate or other fixing fluids.

8. Please add whatever else may occur to you as important and worthy of the committee's attention.

(This was intended to include discussion of such matters as

(a) Other pathological or bacteriological materials than those mentioned above, where it seemed probable that the mails might be used for their transmission.

(b) Present methods of packing, specifications regarding construction and restrictions in use of the mails with criticisms and suggestions for improvements.

It is imperative that no possibility of contamination of the mails, etc., be possible; that the case or cases recommended be not so heavy as to make postage too expensive; that specifications be broad enough to meet as many of the needs as possible and as many of the views of laboratory workers relative to convenience, etc., as is practicable.

Another very important matter is to secure and recommend a form or forms of case, packing, etc., which could be manufactured and sold without infringing present or future patent-rights. Each person

who would use such an outfit should have the privilege of getting it made at the place most convenient or desirable to himself and if it seems best, under his own eye. Please give the fullest suggestions and any criticisms which may occur to you. The need for definite action is daily more apparent.

In response to this circular, practical suggestions and criticisms were received from individual members of the committee, which may be summarized as follows:

1. *Cultures of Bacteria.* Whilst it would seem safer, where possible, to hermetically seal the tube containing the culture, this may not always be practicable. Under all circumstances in the sending of living cultures of bacteria both an inside and an outside case should be used. Cultures in fluids or on media which seem *likely* to become fluid at a relatively low temperature, or which are liable to become digested by the growth of the bacteria, should be sealed by fusing the glass, covering the tube with a *fresh* rubber cap. treating the cotton plugs with paraffin or hermetically closed by some other reliable method.

2. *Diphtheria Specimens.* The practice in different laboratories varies. Some boards of health furnish physicians, inspectors and other persons throughout the state, city or territory tributary to the laboratory with a dry swab in a glass or metal tube. This is used for swabbing the throat of the patient in whom diphtheria is suspected. On receipt in the laboratory culture media are sown from the swabs. Provision of safe methods of transmitting through the mails such relatively dry swabs is much simpler than in the case of fluids.

Other laboratories insist upon inoculation of the media at the bedside by the physician because they have found that *bacillus diphtheriae* sometimes does not develop on the culture media sown in the laboratory from the swabs forwarded from patients in whom *bacillus diphtheriae* is present. This difference of opinion amongst laboratory workers is based upon a difference in their experiences; some laboratories report development of cultures of *bacillus diphtheriae* from dry swabs which had been weeks or months in transit.

Certain boards of health require for release of quarantine specimens from both nose and throat. With these requirements it would appear to be highly desirable that all the materials necessary for the sending of specimens from one patient be transmitted in a single package. It is possible that in the throat or nose of a diphtheria patient microorganisms may be found which are capable of rendering serum media completely liquid in a few hours without necessarily destroying the diphtheria bacilli present. For this reason diphtheria cultures on serum media should be treated as fluid cultures.

In order to satisfy the requirements of all laboratories it becomes necessary to provide for the sending in one package of either

(a) One or more relatively dry swabs.

(b) One or more inoculated tubes of serum culture medium.

(c) One or more swabs and one or more inoculated tubes of serum culture medium.

3 and 4. Specimens of Blood for "Widal Reaction" Test and Blood from Malaria Patients. These substances when dried upon glass, paper, foil or other suitable material appear to present few difficulties so far as safe transportation through the mails is concerned.

When dried upon glass care must be taken to provide pasteboard, metal or other containers, which will render breakage unlikely to occur and should it occur prevent the escape of broken glass amongst the contents of the mail bag.

Dried blood from typhoid or malaria patients may perhaps be regarded as harmless. Dried blood from other sources may not, however, be so harmless. In case, therefore, of possible oversight or error on the part of the sender it would seem well to safeguard the sending of specimens of dried blood from even typhoid and malaria patients.

5 and 6. Sputum, Blood, Faeces, Pus, Exudate, Urine, Etc., when fluid might well be treated like cultures in liquid media or in media which may become liquefied during transit. The tube or phial used to contain the specimen should be made absolutely tight by a suitable cap, stopper or other reliable means.

If forwarded dry on a swab there would be relatively less danger of infection and such specimens might be treated like diphtheria swabs.

7. Pathological Specimens Fresh or in Fixing Solutions. When small pieces (not to exceed one-half inch in any diameter) have been exposed for some time prior to shipment in a fixing solution which is also a good germicide, so that all contained bacteria are dead they cease to be "diseased tissues" so far as capacity for infection is concerned. If surrounded by absorbent materials moistened with the fluid used for their fixation, it is necessary only to guard against leakage and damage to the other mail with which such packages may come in contact.

For fear, however, of error in judgment regarding the killing of contained bacteria by the solutions employed it would seem well to treat all such specimens like cultures of bacteria.

8. Suggestions as to Methods of Procedure, Criticisms of Methods Hitherto Employed, Etc.

(a) Manufacture of outfits by or for the governments and their sale at postoffices, as is the case with postage stamps, stamped envelopes, postal and letter cards, etc., has been suggested.

Whilst this would ensure the use of suitable outfits in all instances, its practicability has yet to be demonstrated.

(b) It seems well to enlarge the number of the laboratories to which the privilege of using the mails for the transmission of diseased specimens is extended. The present U. S. regulations include only the "United States, state and municipal laboratories." College, university and private laboratories should be perhaps included. Such a change may be found possible. Under the present U. S. regulations it is necessary to obtain a permit from the Postmaster General before a laboratory is allowed to receive specimens through the mails. It is impossible for any laboratory to know what specimens may be sent to it and it should, therefore, not be held responsible for the senders' errors. It would seem advisable to secure regulations so definite and methods so perfect that the use of the mails for transmission of specimens of diseased tissues may be extended to all physicians and all laboratories.

(c) The provision of suitable penalties for infringement of such regulations would appear to be necessary.

(d) The form of outfit used by the Colorado State Board of Health for the transmission of diphtheria swab specimens has been inspected by the members of the committee. It consists of

(a) A test tube (5 inches long and one-half inch wide), containing an aluminum wire (No. 15 gauge) upon the lower end of which is wound tightly absorbent cotton to form a swab. The mouth of the test tube is plugged with absorbent cotton, which also serves to keep in place the free end of the aluminum swab which projects about one-eighth inch beyond the mouth of the tube.

(b) Around the test tube is rolled a data card which is held in place by an elastic band.

(c) A cylindrical tin box 1⅛ inches in diameter and 5½ inches long, which is provided with a circular tin cap (drawn), fitting somewhat loosely and extending down over the mouth of the box for ¼ inch, contains the test tube. In the bottom of the tin box is some loose absorbent cotton upon which the test tube rests.

(d) The tin box is contained in a box made of compressed paper, which is 5¾ inches in length over all, 1⅝ inches in diameter outside and 1⅜ inches inside. The bottom consists of a circular piece of turned wood ¼ inch thick, which is glued into place. It is closed by a tin screw cap.

Criticism of this outfit seems to show that whereas certain changes seem advisable in its method of construction and use it would appear possible to modify it so as to make it fulfill requirements.

(e) The present regulations for both moist and dry specimens are not sufficiently elastic to meet the requirements of those affected nor do they seem to be entirely compatible with safety in all respects.

The terms "moist" and "dry specimens" at present used in the U. S. regulations may be perhaps retained.

Moist specimens should include *all* cultures of bacteria, fluids, fresh and probably preserved tissues.

Where fluids are to be transmitted a limit should be placed upon the quantity sent in any one package.

Both an inside and an outside case should be provided for the transmission of moist specimens. The inside case should be water tight and not of such materials as would readily split or crack.

Antiseptic absorbent packing should be used in quantity sufficient to absorb all fluids originally present or present as the result of melting or liquefaction.

The outside case should be water tight and sufficiently rigid to do away with danger of breakage. Its method of closing should be such as to prevent loosening of the joint. Should the joint in the outer case become loosened the structure should be such that the cover or joint of the inside case is not also thereby loosened.

Dry specimens may include specimens of blood, nose or throat exudate, pus or other materials collected upon a dry cotton swab or carrier or upon a probe, loop or other wire.

For these specimens less protection seems necessary. Where a glass test tube or other brittle container is used to contain the swab, provisions must be made against breakage, and in the event of breakage, the escape of the bits of broken glass must be safeguarded.

A metal or other carrier with a tight screw joint or top appears to be advisable. The rubber gasket may perhaps be unnecessary.

Dried blood smears, if on glass slides or cover slips, should be enclosed in paste board or wooden boxes or other receptacles of such construction as to ensure protection against the breakage of the glass. Should breakage occur, the pieces of glass must be so enclosed as to render their escape impossible.

Blood dried on aluminum or other foil, paper or other non-breakable material must be enclosed in a tightly sealed envelope, and this, again, in a second envelope also tightly sealed. Other suitable methods may be devised.

NOTE.—*Specimens* supposed to contain the bacillus of bubonic plague and specimens from smallpox patients, should not be sent through the mails.

Summary. Whilst it is impossible at this date to make final report, much time and thought have been given to the matter by your com-

mittee and quite a sum has been expended in the elaboration of models.

Drawings, provisional specifications and finished samples of several forms of outfit have been provided. Each member of the committee has these under consideration at the present time.

The outfits under consideration include in brief:

1. A double metal case closed by two fine screw joints. It is intended for the transmission of a single dry swab for diphtheria or other work.

2. A metal case with screw cap for the transmission of a swab coated with sterilized Loeffler serum. The swab is contained in a fused, thick-walled glass tube. Such an outfit will keep for years and may be used for diphtheria, etc. It is designed to prevent the complete drying up of the bacteria during transit.

3. A brass or aluminum outside case with union joint is made tight by a rubber gasket.

A water-tight inner case made of paraffined paper, paste board, light tin or other material is provided with absorbent felt, cotton or both, sufficient in amount to absorb all fluid in case of breakage.

This is suitable for the transmission of one to three or more cultures, swabs or even moist specimens of sputum, blood, tissues, fæces, etc., when packed according to specifications.

4. An outside case of turned wood, with a rubber gasket at the joint about midway between top and bottom. Two methods of fastening are provided. There is also supplied an inner tin case with sliding or screw cover or a water tight case of paraffined paper may be used. This outfit is suitable for the transmission of one to three cultures of bacteria when packed as specified or for the carrying of swabs or even moist specimens.

It is hoped that during the time of the meeting of the Association at Buffalo, Sept. 16 to 20, 1901, opportunity may be afforded your committee for a comparison of views, a discussion of methods and the formulation of final recommendations.

Should this be possible, it would seem desirable that such final report appear in the transactions of the Association for the present year.

(Signed) J. A. Amyot.
John S. Fulton.
Henry D. Holton.
Henry Mitchell,
Domingo Orvanaños,
George E. Tyler.
Walter Wyman.
F. F. Wesbrook, Chairman.

REPORT OF THE COMMITTEE ON NATIONAL LEPER HOMES.

By HENRY M. BRACKEN, M. D., Chairman, St. Paul, Minn.

Your chairman has written to the various members of the committee asking for suggestions or advice bearing upon the establishment of national leper homes, but has received no replies. Your chairman has made no special investigation of leprosy since the last meeting of the Association, but he is still firmly of the opinion that at least two such homes should be established in the United States, under federal control: one at some point in the northern part of the United States in a climate well adapted to people from the northern countries of Europe, such as Norway, Denmark, Iceland, etc.; the other at some point in the southern part of the states in a climate suitable for those of our own citizens accustomed to a semi-tropical climate.

It would seem that the time is ripe for asking of the United States Congress the establishment of these homes. Your committee would, therefore, request that the various members of this Association resident in the United States, appeal to their representative senators and congressmen to aid in the establishment of such homes, drawing their attention to the resolutions which were adopted by this body at its meeting in Indianapolis, September, 1900, which read as follows:

"Whereas, It is a known fact that lepers are found in Canada, the United States and Mexico; that these lepers represent immigrants of many nationalities, together with some Americans; that the exclusion of leprous immigrants by inspection is impossible; that the tendency to importation of leprous immigrants in the future will be greater even than in the past; that the danger of infection of American residents abroad and the importation of the disease through these channels is greatly increased; therefore, be it

Resolved, That this Association place itself on record as favorable to the establishment of National leprosaria, which may serve, not only as a refuge for lepers, but also as a home and hospital, making their lives tolerable so far as possible, furnishing employment to those who are able to work, and giving skilled medical care to all cases, with the intent of possibly curing some, and making the road to death less wearisome and painful than it now is to others.

THE BRITISH CONGRESS ON TUBERCULOSIS, JULY 22-27, 1901.

By F. MONTIZAMBERT, M. D., Ed., F. R. C. S. E., D. C. L.,

Director General of Public Health of Dominion of Canada.

Some 2,500 British and foreign delegates accepted the invitation to the Congress on Tuberculosis which His Royal Highness the Duke of Cambridge opened on the 22d of July, on behalf of the King. These delegates included many of the most eminent pathologists and physicians in the world; they represented the new science in medicine and surgery. It is to be hoped that the lessons of the Congress will spread far beyond the limits of the volumes of its transactions. As to the arousing of public interest, it is a good omen that His Majesty has always been keenly alive to the need of further effort, and that the first year of his reign has been signalized by a congress on a subject so vital to the interest of the nation. And that the Governor-General of Canada has also caused the formation of, and consented to preside over, a Canadian association for the prevention of this disease.

Great stress was very rightly laid upon the curability of the disease, if taken in time. It was advocated, however, that to secure such early treatment, it would, in many cases, be requisite to render aid to the dependents, in addition to treating the patient. One advantage accruing from such procedure is that the patient, freed from anxiety for his family, would enjoy a much better hope of recovery. The need of increased efforts in routine sanitary administration was not forgotten. All are agreed upon the possibilities for good in the amelioration of the housing of the poor. Almost as much importance also is to be attached to the proper supervision of tenement houses as to the clearing of unhealthy areas.

All speakers agreed in regarding human sputum as the chief vehicle of tuberculous infection amongst the human race. The modern education of consumptive in-patients at hospitals and sanatoria, and the printed directions distributed in out-patient departments, show patients how they may—by the control and destruction of their expectorations —avoid infecting their relations and friends.

In short, general hygienic knowledge in regard to the nature and prevention of tuberculosis is being gradually published amongst all classes in civilized countries. Yet it is not likely that infection by sputum can be suppressed, so long as it remains the popular custom for

persons, healthy or unhealthy, to spit in the streets, in omnibuses, in railway carriages and on the floors of waiting rooms, etc.

In his public address before the Congress, Professor Brouardel of Paris, dwelt specially on the evils of this deplorable habit of spitting.

"The danger is in the sputum, which contains thousands of contagious germs. To expectorate on the ground is a disgusting and dangerous habit. Once this habit has quite disappeared, tuberculosis will decrease rapidly."

Gradually in all countries the public are beginning to realize that personal care and cleanliness are necessary to obviate contagion, and are also realizing that other idea, equally important, that a consumptive patient is only dangerous if the necessary precautions are not taken around him, and if he himself does not take them to protect his relatives, friends and fellow workmen from contagion.

The generally accepted beliefs that tuberculosis is not hereditary, and that it is not necessarily incurable, were also again dwelt upon in this Congress. With regard to heredity, Professor Brouardel dismisses it with the phrase: *"On ne nait pas tuberculeux mais tuberculisable."* And stress was again laid upon the importance of the open air treatment, with rest and generous diet, in the treatment of the disease.

It will probably be generally admitted that the feature of the Congress was the address by Dr. Koch, more particularly that part dealing with the alleged non-identity of bovine and human tuberculosis and the non-transmissibility of the disease from the one to the other species. The author's position and reputation are such that the greatest consideration should be accorded to any opinion expressed by him, no matter to what extent his pronouncements may be at variance with previously accepted doctrines or experience. In the present case, Dr. Koch has startled the scientific world by declaring that the bacillus of bovine tuberculosis is not the same as that of the human disorder, that the bacilli from the latter will not infect the former, and that there is practically no real danger of any transmission of infection from tuberculous cattle to man.

His actual words in this connection were: "Though the important question whether man is susceptible to bovine tuberculosis at all is not yet absolutely decided, and will not admit of absolute decision to-day or to-morrow, one is nevertheless already at liberty to say that, if such a susceptibility really exists, the infection of human beings is but a very rare occurrence. I should estimate the extent of the infection by the milk and flesh of tuberculous cattle, and the butter made of their milk, as hardly greater than that of hereditary transmission, and I therefore do not deem it advisable to take any measures against it."

On the other hand, the current view and practice of local sanitary authorities in England have been in accord with the unanimous findings of two Royal Commissions (the first containing such experts as Sir G. Buchanan and Sir J. Burdon-Sanderson, and the last the late Sir Richard Thorne and Mr. Shirley Murphy). In paragraph II of the last Commission's report, they say: "We have had before us the unanimous finding of the Royal Commission on Tuberculosis, which reported in 1895 to the effect that tuberculous disease in bovine and other animals is identical with that in the human subject, and that it is communicable from one to the other, though the manifestation of the disease differs in some respects in the human subject from that in the lower animals. We have also considered their finding that 'any person who takes tuberculous matter into the body as food, incurs risk of acquiring tuberculous disease.' Nothing that has come before us in the course of our inquiry has raised any doubt in our minds as to the accuracy of this opinion." The views of the two Commissions and those of Professor Koch are thus absolutely contradictory.

Yet the identity of human and bovine tuberculosis is ordinarily imagined to rest on Dr. Koch's own discoveries, when he found and proclaimed to the world, that the lesions in man and those in animals contained bacilli absolutely alike in general and special characters. If this be the case, the assumption that bacilli can be transmitted from one organism to the other is, *a priori* reasonable and likely, and the growing conviction on this point has never been seriously contested for the last eighteen years. Ordinary experience seems also to confirm this view. Dr. Koch points to the fact that, according to the hitherto recognized theory of transmission, cases of infection from milk ought to be exceedingly common, whereas instances of primary intestinal tuberculosis are extremely scarce. Here, however, there are observers who would meet him with a direct negative. Cases of specific bovine infection may be relatively rare, but there are a good many recorded.

If Dr. Koch is right, we shall all rejoice, and, therefore, we must earnestly hope that he is. But the question is, can his theory be safely accepted? That can only be decided by an examination of the facts on which it is based. No authority, however great, can lay down a law in science by the mere weight of his opinion, and with all due respect to Professor Koch, he is not altogether free from the suspicion of having jumped somewhat too hastily to conclusions in regard to other matters. The feeling throughout the Congress seemed to be that Dr. Koch's statements were made prematurely, and upon insufficient data, and that, should they prove to be wrong, the amount of harm done may be incalculable. The evidence which he brought forward in support of his views by no means carried conviction to his hearers. One of these, at least, enjoys an eminence equal to his own. Lord Lister, who

occupied the chair, spoke with no uncertain voice on this matter. While paying a generous tribute to his colleague, and to the profound interest of his paper, he pronounced the argument not conclusive, and declared that the question must be probed more deeply before the Congress would accept Dr. Koch's hypothesis. It would, he said, be a grievous matter if the efforts now being made to secure the purity of milk and meat supplies should be relaxed, and then it should turn out, after all, that the danger was real. It is not usual to have a discussion on an address delivered before a general meeting, and the importance attached to the question by the chairman was sufficiently shown by his calling on several other members to speak upon it.

Professor Nocard, who is the leading authority on veterinary medicine in France, expressed his sense of the honor paid him, and his pleasure in joining in thanking Professor Koch for his admirable address. Speaking as a member of the veterinary profession, he referred to the movement they had recently had to encounter from exaggerated fears of the danger connected with animals; and perhaps there would be a reaction too far in the other direction. He thought they ought neither to exaggerate the danger nor deny its existence. He then pointed out that the facts related by Professor Koch might be explained by the modification which microbes undergo from their environment. With regard to incommunicability from animals to man, veterinary surgeons were not infrequently inoculated from bovine disease by accident, and there were many other examples of similar inoculation. He also referred to the facts brought forward by the late Sir Richard Thorne in his work on "The Administrative Control of Tuberculosis.' Sir Richard Thorne had shown that tuberculosis had been diminished in England 50 per cent by sanitation, but there was one form of the disease that was an exception, namely: the abdominal tuberculosis of infants, or tabes mesenterica, and the sole reason why that had not diminished was that the infection was derived from tuberculous milk. He agreed with the chairman in desiring further inquiry.

Professor Bang, of Copenhagen, was then called upon by the chairman, and said that he thought Professor Koch had gone a little too far in saying that there was no necessity for taking measures against bovine tuberculosis. He had proved that there was very little danger in inoculating cattle from man, but the inoculation of man from cattle was a different matter, and they should be cautious in accepting his conclusions about it.

Professor Sims Woodhead (Cambridge) was also called upon. He said that Professor Koch's paper was a masterly exposition of his subject, but the very weight of his word going out to the world made it desirable that, if there was anything to be said on the other side, it

should be known too. He was himself convinced that bovine tuberculosis did play some part in the extension of the disease, and he adduced several reasons for his opinion. Among them he referred to an experiment of Professor Crookshank's, and said that one such positive result outweighed a large number of negative ones. Professor Koch had told them that a commission had been appointed in Germany to make further investigations, and he suggested that the same should be done in England, and that the Minister of Agriculture should be approached with that object in order that the question might be settled by actual experiment. But for the present he strongly urged that they should continue to take precautionary measures.

On the day following Professor Koch's speech, the general address was delivered by Professor Brouardel, Dean of the Faculty of Medicine of Paris, the leading sanitary adviser of the French Government, and one of the highest authorities upon sanitary matters in Europe. On the question of the moment, his views are diametrically opposed to those of the German bacteriologist.

Amongst other things, he said: In our food danger lurks. Since Chauveau showed that it was possible for tuberculous germs in food to produce tubercles in the intestinal tract, attention has been turned to precautions for preventing the consumption of meats and milk from tuberculous animals. As far as meat is concerned, surveillance of the slaughter houses in large towns achieves this. In Belgium this measure is also made to apply to the country; but I do not know of any other kingdom where private slaughter houses are inspected, and in them it is that phthisical cows, measly pigs and diseased animals of any kind are slaughtered, and are able to escape inspection. This injurious food is consumed either as fresh meat, or in the form of pâtés or sausages from which the tuberculous viscera have not been removed. With no wish to exaggerate the danger of the propagation of tuberculosis by meat, it cannot be overlooked. That the milk of cows with tuberculous inflammation of the udder is used is very clear. Your great hygienist, Dr. Richard Thorne, while pointing out that in England mortality in general of adults from phthisis has diminished since 1850, 45 per cent., regerts to see that from the same date infantile mortality from tuberculosis increased by 27 per cent. According to him, this increase is entirely due to tuberculosis in the abdomen, caused by ingestion of contaminated milk in infants, under a year old; for in England cow-houses are not inspected. It is well to add that in large concerns the milk from different sources is mixed, and one cow only need be the victim of tuberculous udder, in order to contaminate all the milk with which its milk is mixed. To prevent this method of propagation, strict inspection measures should be adopted, such as have been in use

for several years in Denmark, Sweden and Norway, to the great advantage of public health. Until such necessary measures are actually adopted, there only remains the simple mode of avoiding risk from milk by boiling it, and this should be widely made known, in spite of a too wide-spread prejudice, which wrongly holds that boiled milk is less nutritious and indigestible.

The next day the third and last general address was given. It was by Professor John McFadyean, the head of the Royal Veterinary College at Camden Town. He summarized Dr. Koch's theory, as follows:

(1) That human and bovine tuberculosis are not identical:

(2) That human tuberculosis can not be transmitted to cattle:

(3) That the transmission of bovine tuberculosis to man is so rare that it is not necessary to take any precautions against it:

Professor McFadyean began by pointing out the unanimity of opinion on the identity of the two forms of disease, and upon the fact of their intercommunicability. He agreed with Dr. Koch that bovine tubercle bacilli were, as a rule, distinctly more virulent for cattle and other domesticated animals than human bacilli, and that the results of experiments indicated that in natural circumstances there was little danger of cattle becoming infected from human beings. But Professor McFadyean joined issue with Dr. Koch on his other postulate, viz.: The rarity of the transmission of bovine tuberculosis to man. He reminded the Congress that the majority of disease-exciting bacteria were harmful to only one or two species, but all those that were common to all the domesticated animals were also pathogenic to man.

The only proposition in Dr. Koch's argument that was really germane to the point at issue was that only cases of primary intestinal tuberculosis could possibly have had their origin in infected milk or meat, and that "such cases were extremely rare." If all the statistics relating to this point were unanimous, it would have to be admitted that primary intestinal tuberculosis was rare in the human subject, and that cases of infection through milk were still rarer, though even then it might be advisable to take steps to prevent the few cases. But the statistics were by no means unanimous, and those that were likely to appeal with most force to the people of England were not at all in accord with those quoted from Germany. During the last few years the evidence obtainable from the post-mortem records of two of the largest hospitals for children in Great Britain had been analyzed with great care, to see what evidence they afforded as to the relative frequency of the different methods of infection in tuberculosis.

In the case of the Royal Hospital for Sick Children in Great Ormonde street this had been done by Dr. George Still, and in the case of the

Royal Hospital for Sick Children in Edinburgh by Dr. Shennan. The conclusion at which Dr. Still arrived was that in 29.1 per cent of the cases of tuberculosis in children primary infection appeared to have taken place through the intestines. That was very far from being an insignificant proportion, and it was a striking fact that Dr. Shennan arrived at an almost identical conclusion, and estimated that 28.1 per cent of the cases of tuberculosis among children in Edinburgh were due to alimentary infection. In face of these statistics, it was not possible to assent to the statement that cases of primary tuberculosis of the alimentary canal were extremely rare. Precisely the contrary conclusion was the one that must, in the meanwhile, be drawn with regard to the state of affairs in Great Britain, viz.: that at least in children primary infection of the alimentary canal was comparatively common. Professor McFadyean proceeded to examine very carefully the danger through the sale of milk, quoting the late Sir Richard Thorne, to the effect that the loss of child life through the use of tuberculous milk was "appalling," and summing up his conclusions on the whole case in the following passage:

"The danger can not be defined by stating how many persons are thus infected annually, or what fraction the persons thus infected form of the total number who contract tuberculosis in the course of a year. At the same time, it is impossible to doubt that the danger is a very real one, since at the present time milk is a vehicle by which tubercle bacilli are often introduced into the bodies of human beings."

Professor McFadyean then dealt with the means of averting the danger, maintaining that the ideal method of counteracting this source of human disease would be to stamp out living tuberculosis, or to prevent the sale of milk from every cow that was tuberculous.

And he ended his address with the following words: "In conclusion, I would venture to express the earnest hope that the Congress will not endorse the view that it is inadvisable to take any measures to prevent the transmission of tuberculosis from the lower animals to human beings. To justify the introduction of measures to that end, it is not necessary to contend that this is a common method of infection, or that the danger arising from milk can for a moment be compared with that present in human sputum. The inhalation of tubercle bacilli expelled from the bodies of human patients is doubtless the great cause of human tuberculosis, and every practicable means of preventing infection in that way ought to be employed: but, at the same time, we ought not to concede to the milkmen the right to sell us tubercle bacilli, even if we were assured that—like Dr. Koch's experimental pigs—we had nothing to fear beyond the development of "little nodules here and

there in the lymphatic glands" of our necks and "a few grey tubercles" in our lungs."

Professor Virchow in an interview reported from Berlin, under date of July 26th, says he has for years fought against the idea of the hereditary transmission of tuberculosis. He disagrees, however, with Professor Koch's deductions with regard to bovine tuberculosis and its transmission to man. Professor Koch, Dr. Virchow says, has quite ignored the investigations of the Copenhagen School and the results they have obtained.

It will be clearly seen from the foregoing that the position of all these eminent authorities who criticised Dr. Koch's announcement was essentially uniform.

They deprecated a hasty conclusion, on inadequate evidence, and gave weighty reasons for differing from Dr. Koch; they pleaded for further investigation, and urged the continuance of the present preventive measures until the issue has been decided. There is no doubt that this is the wise course to adopt. Professor Koch would, probably, say the same himself. In fact, he suggested that his experiments should be repeated, in order that all doubt might be removed. It seemed to be generally considered a pity that he has given this marked publicity to theories of such importance while any doubt remains.

Meanwhile, is it unreasonable to take the position that presumption should be against the consumption of milk from other than healthy cows, and that meat and milk plus disease products, tubercle bacilli, or what not, is not of the quality and nature reasonably expected by the purchaser from the vendor, or that we desire to use and to give to our children, and that while doubt exists no relaxation of measures directed towards ensuring their purity should be permitted?

Science will achieve a useful work if she imbues us with a wholesome dread of tuberculous meat and milk and other harmful food, although it may be that tuberculous food has in no case set up tubercle in any healthy person. Pasteur, in studying the diseased silkworms, traced the evil to a microbe, but far the more valuable and suggestive outcome of his researches was the discovery that so long as the silkworms were in health they laughed and waxed fat on the microbe. Only when they deteriorated in condition and suffered from digestive derangement could the microbe enter in and devastate them.

Professor Koch's failure to induce tuberculosis in healthy animals by means of feeding them on a tuberculous diet is only another illustration of the fact that health is a weapon whereby the microbe, whether of tuberculosis, of diphtheria, or of any other disease, can be successfully combated. The indication and the duty of modern science, there-

fore, is to raise by all possible ways of sanitation, legislation, and by the spread of knowledge, the standard of health.

Other matters of importance that engaged the attention of the Congress were the questions relating to the claim for notification of phthisis, and for power to compel the disinfection of infected houses and articles; the proposals for public aid, not only for the tubercular breadwinner himself but for those non-infected persons who are dependent upon him; consumption hospitals; and sanatoria.

With regard to consumption hospitals and special consumption wards in general hospitals, it was urged that if only a considerable fraction of the whole number of consumptives were suitably lodged in this way, a diminution of infection and consequently of the sum total of tuberculosis could not fail to be the result.

In regard to the modern sanatorium, Koch allows that by careful selection of cases it will be possible, if the duration of treatment be prolonged, to cure 50 per cent of patients or perhaps still more. The total effect, however, he is convinced, will always remain moderate. Be this as it may, it must in fairness be remembered that it is largely owing to the sanatorium movement that the present great international interest in the tuberculosis question has arisen. To the managers of private sanatoria, though they have by some been slightly compared to hotel keepers or hotel managers, is due much of the credit for the great advances which have been made during recent years in our knowledge of the whole subject of the treatment of consumption. In the struggle against tuberculosis the importance of improving the general health of weakly children of the poorer classes by the establishment of charitable seaside sanatoria and holiday colonies, as referred to by Professor Brouardel and Sir Hermann Weber, cannot be overlooked. This is, indeed, a timely method for rendering the human soil unsuitable to the bacillary growth.

As a delegate representing Canada, in an address before the State Section of the Congress, I spoke of the present conditions in the Dominion as to tuberculosis, and the measures being taken towards its prevention and cure. I drew attention to the fact that these measures —until recently only the action of boards of health, of medical societies, of comparatively small associations, and of individuals—have this year been widened and extended into a great national movement by the action of Lord Minto, His Excellency the Governor-General, in organizing and setting in motion The Canadian Association for the Prevention of Tuberculosis, of which he is the honorary president.

I referred to the sanatoria already in existence and at work amongst us; and to the recent legislation of some of our provinces towards the establishment of provincial and municipal sanatoria. And I pointed

out how admirably our climate, with its dryness and clearness of atmosphere, is adapted for that open-air treatment which is now universally admitted to be the most important factor in the hoped-for cure of this disease.

The final meeting of the Congress was held on July 26th, with the Earl of Derby in the chair. The following resolutions were unanimously adopted:

1. Tuberculosis sputum is the main agent for the conveyance of the virus of tuberculosis from man to man. Indiscriminate spitting should therefore be suppressed.

2. All hospitals and dispensaries should present every out-patient with a leaflet on the prevention of consumption and insist on the use of a pocket spittoon.

3. Notification of tuberculosis should be established, when possible. If compulsory notification is impracticable, voluntary should be encouraged.

4. The provision of sanatoria is an indispensable part of measures for the diminution of tuberculosis.

5. Medical officers of health should use all their powers and relax no effort to prevent the spread of tuberculosis by milk and meat.

6. In view of the doubts thrown on the indentity of human and bovine tuberculosis, the government is requested to institute an inquiry into the subject.

7. The educational efforts of the great national societies for the prevention of tuberculosis are deserving of support.

8. A permanent international committee should be appointed to report on the measures for the prevention of tuberculosis in different countries.

9. Overcrowding and defective ventilation, damp and insanitary dwellings of the working classes diminish the chances of curing consumption, and are predisposing causes of the disease.

10. The attention of governments and charitable persons should be called to the necessity for establishing anti-tuberculous dispensaries.

REPORT OF COMMITTEE ON ANIMAL DISEASES AND ANIMAL FOOD.

By D. E. SALMON, D. V. M., Chairman, Washington, D. C.

Your Committee on Animal Diseases and Animal Food has been impressed with the importance of the discussions which occurred at the recent British Congress on Tuberculosis concerning bovine tuberculosis and its effects upon the public health. Some of the opinions expressed at that Congress have aroused the most extended interest among physicians and among laymen, and it seems appropriate that your committee should at this time review the subject at some length, in order to make clear what is already known, preparatory to taking steps to definitely settle contested questions by experimentation.

EXTENT OF BOVINE TUBERCULOSIS.

The extent and rapid increase of bovine tuberculosis in various countries has during recent years caused alarm, both because of its effects in reducing the general food supply and its supposed danger to human health.

The slaughterhouse statistics of Prussia show 14.6 per cent. of the cattle and 2.14 per cent. of the swine to be tuberculous. In Saxony the percentage is 29.13 with cattle and 3.10 with swine. In the city of Leipzig the figures are 36.4 with cattle and 2.17 with swine. (Siedamgrotzky). Of 20,850 animals in Belgium tested with tuberculin in 1896, 48.88 per cent. reacted. (Stubbe). Of 25.439 tested in Denmark from 1893 to 1895, 49.3 per cent. reacted; and of 67,263 tested from 1896 to 1898, 32.8 per cent. reacted. (Bang). An examination of 20,930 cattle in Great Britain, either slaughtered and examined postmortem or tested with tuberculin, showed 5,441, or 26 per cent., affected with tuberculosis. MacFadyean estimates that 30 per cent. of the cows in Great Britain are tuberculous.

We have no figures in the United States which cover a sufficient area of our territory to allow us to make a reliable estimate of the extent of tuberculosis with milch cows. There is little doubt, however, but that the disease has been increasing both with dairy cattle and swine. From a recent review by Russell and Hastings, of the Wisconsin Agricultural Experiment Station, of tests of cattle for tuberculosis which have been made in the United States the following summary is presented:[1]

[1] Bulletin No. 84, Wisconsin Agricultural Experiment Station, March, 1901.

	Number Tested.	Number Tubercular.	Per cent. Tubercular.
Vermont	60,000	2,390	3.9
Massachusetts	24,685	12,443	50.
" Entire herds	4,093	1,080	26.4
Connecticut	6,300	.....	14.2
New York, 1894	947	66	6.9
" 1897-98	1,200	163	18.4
Pennsylvania	34,000	4,800	14.1
New Jersey	2,500	.....	21.4
Illinois, 1897-98	929	.....	12.
" 1899	3,655	560	15.32
Michigan	.....	.....	13.
Minnesota	3,430	.....	11.1
Iowa	873	122	13.8
Wisconsin—			
Experiment Station tests:			
Suspected herds	323	115	35.6
Non-suspected herds	935	84	9.
State Veterinarian's tests:			
Suspected herds	588	191	32.5
Tests of local veterinarians under State Veterinarian, cattle intended for shipment to States requiring tuberculin certificate	3,421	76	2.2

The State Veterinarian of Pennsylvania, Dr. Pearson, thinks that not over 2 per cent. of the cattle of that State are tuberculous, and probably if a general test of all the cattle of the other states mentioned were made we should find a very much smaller proportion tuberculous than is indicated by this tabular statement. The explanation of the high percentages that have been given is found in the fact that it has been for the most part suspected herds which have been tested. Admitting that the greater part of these percentages are too high, they are still sufficient to demonstrate the wide distribution of tuberculosis and its comparative frequency.

Our beef cattle as they come to the large packing houses are yet comparatively free from tuberculosis. Of 4,841,166 cattle slaughtered in the year 1900 under federal inspection, but 5,279, or 0.11 per cent., were sufficiently affected to cause the condemnation of any part of the carcass. Of 23,336,884 hogs similarly inspected, 5,440 were sufficiently affected to cause condemnation of some part of the carcass. This is equal to 0.023 per cent., or slightly more than one-fifth the proportion found in beef cattle.

The slaughterhouse statistics of all countries show that the percentage of affected hogs increases as the disease becomes more common in cattle; so that we must consider not only the effect of the disease upon beef and milk producing animals, but also upon our swine. The disease is more acute with hogs than with cattle and there is a much

greater tendency to generalization, consequently the parts used for human food are more likely to be affected, and if there is a possibility of communicating the disease through the meat the danger is increased by this peculiarity of these animals.

EFFECT OF PRODUCTS OF DISEASED ANIMALS ON PUBLIC HEALTH.

Admitting, as we must, the increase of this disease among our food producing animals, particularly cattle and swine, it appears to your committee that this fact should cause concern from a public health standpoint irrespective of the question of the direct communicability of tuberculosis from animals to man. The people of the United States have always demanded meat from animals which were free from disease. Animal food has been so abundant and so cheap that even the poorer classes of our population have been able to use only the best. There is no reason apparent at this time why they should depart from this rule and be asked to consume the products of animals affected with tuberculosis. Animals so affected often have mixed infection, with high temperature, the formation of pus in different parts of the body and particularly in the mammary glands, and there is undoubtedly in many cases a considerable development of toxins. The flesh of such animals must be affected in the same way as is that of animals affected with other fevers and septic conditions. The extensive development of tubercular lesions in the udder affects the secretion of milk, changes its composition, causes the secretion of great quantities of pus which are mixed with the milk, and leads to the development of a great variety of saprophytic germs which multiply in the milk and develop various decomposition products.

The consumption of food of this character has always been considered harmful, and especially so to children. It may seriously affect the digestion and cause diarrhoea and other forms of illness by the toxins which it contains. It is extremely desirable that the source of our food supply should be guarded from contamination by disease and kept in as nearly a normal and healthy condition as possible. Every departure from this ideal state is a menace to the consumer and an injury to the public at large.

THE COMMUNICABILITY OF BOVINE TUBERCULOSIS TO MAN.

The important question as to whether bovine tuberculosis can be directly communicated to man has attracted considerable attention in this country for several years, and was discussed in the report of this committee at the last meeting. The conclusion had already been reached by some writers in this country that mankind was not susceptible to the form of tuberculosis which affects cattle. Now that this

conclusion has been accepted and promulgated by Koch in his address at the British Congress on Tuberculosis, and has been received so seriously by people generally as well as by the medical profession, it is deemed desirable to recapitulate what was said at that time and to add such further evidence and arguments as are available.

In this discussion we should never lose sight of the fact that even if Koch's position is correct as to the insusceptibility of mankind to bovine tuberculosis—a conclusion which your committee believes is unwarranted by the evidence—and if it is admitted that it is unnecessary to adopt measures against the bovine disease in the fight against human tuberculosis, it does not follow by any means that the products of these diseased animals are harmless and should be allowed to go into consumption. Nevertheless Koch's conclusion is being used already as an argument and excuse for the sale of tuberculous meat and milk. This discussion as to the communicability of bovine tuberculosis should not be allowed to obscure the general question of the importance of condemning meat and milk of diseased animals, whether the disease is or is not a specific one which may be communicated to the consumer of these products. There is no argument to justify the sale of milk secreted from tuberculous udders reeking with pus and the micro-organisms which it contains, changed in its chemical composition, and unsavory to every civilized person. The question of the desirability of measures against bovine tuberculosis as a part of the campaign against human tuberculosis is a thing by itself and entirely distinct from the desirability of such measures from an economic and general public health standpoint.

Whenever this question is discussed in medical meetings or medical journals the general excuse for a toleration of the present condition of affairs is that the danger from bovine tuberculosis has been greatly exaggerated. Quite likely it has been exaggerated by some individuals, but it has just as certainly been underestimated by others. What has been the effect of the discussions heretofore held? Have the public been too much alarmed? Have sanitarians gone to too great extremes? Have we anywhere a too rigid meat inspection or a too careful supervision of the milk supply? If so, your committee is not aware of the fact; and until this occurs, the repetition of the statement that the danger from bovine tuberculosis has been exaggerated appears to be entirely superfluous and useless.

Koch in his recent paper makes two radical assumptions: First, human tuberculosis differs from bovine tuberculosis and cannot be communicated to cattle. Second, mankind is nearly, if not absolutely insusceptible to bovine tuberculosis.

It is incumbent upon us to examine the evidence upon which these propositions rest, for if they can be demonstrated, the fact would be welcomed by every sanitarian, not because it would no longer be necessary for economic and public health reasons to control bovine tuberculosis, but because it would prove that some dangers, which we have hitherto feared, do not exist, and it would simplify the measures needed in the warfare against human tuberculosis. We should not allow ourselves, therefore, to be biased by preconceived opinions, but should honestly and conscientiously weigh all evidence that is presented.

Neither of these propositions is original with Koch, but this is probably the first time that a scientific man of such standing and authority has ventured to adopt them. Sidney Martin, in his experiments for the British Royal Tuberculosis Commission of 1895, showed that sputum from man was far less virulent for animals than was bovine tubercular material. Theobald Smith, Frothingham and Dinwiddie have repeated these experiments with cattle and other animals and incontestably demonstrated this conclusion. It does not appear to be entirely correct, however, to say that human tuberculosis is not communicable to cattle. It would be more accurate to say that, in the experiments referred to, human tuberculosis was only communicated with difficulty to cattle, and when it was communicated it remained localized and did not cause a fatal disease.

Of six calves to which sputum was fed by Martin, two showed no lesions, one had 53, one had 63, and two had thirteen tubercular nodules respectively in the intestines. In one of these animals the mesenteric glands were also affected. Smith also produced small lesions in some of the animals with which he experimented. The failure to cause fatal disease in cattle with sputum bacilli appears to be due to lack of virulence, or we might say to low pathogenic power, rather than to any essential difference in bacilli from human and bovine sources. This is shown by the fact that human bacilli were less active not only when inoculated upon cattle, but also when inoculated upon other species of animals.

The experiments of Chauveau which were made prior to those mentioned above, are more conclusive and cannot be ignored in discussing this question. In one series of experiments he infected two heifers and a bull, all under one year old, with emulsions made from tuberculous human lungs. These infections were by ingestion, but two doses being given to each animal. One of the heifers killed fifty-seven days after infection, had more than 200 tubercles of different sizes in the small intestines. There were also tubercles in the caecum, colon, abomasum, liver and peritoneum. The autopsy on the second heifer occurred

fifty-nine days after infection. In this case the abdominal lesions were insignificant, consisting of two or three follicular hypertrophies in the jejunum and a few small tubercular mesenteric glands. The right submaxillary gland and the two retropharyngeal glands were enlarged and affected with typical tubercular infiltration. The lungs showed not less than twelve tuberculous centers, most of them the size of a walnut, and near these masses were points where tubercular infiltration was beginning. All the bronchial and mediastinal glands were enlarged, tuberculous, and infiltrated with gray and yellow matter. The bull was destroyed on the thirty-fourth day. There was a plain tuberculous eruption in the small intestine, some portions of the mucous membrane, particularly on the Peyer's patches, being covered with confluent tubercles. In the left lung there was a single tuberculous nodule of considerable size and some lobules presented a gelatinous appearance and consistency. There were aggregations of small tubercles in the larynx and upper part of the trachea, some of which were already ulcerated. There were also tubercular granulations in the bronchi. At the time these animals were infected, three similar animals were infected in like manner with bovine material, and three others were held as checks. The latter were found free from tuberculosis. At the autopsy, it was impossible to distinguish any difference between the animals infected with human, and those with bovine material. All were affected and with all the tuberculous lesions had the same characters.

Chauveau, also, made comparative experiments by intravenous injection and subcutaneous inoculation; from all of which he concluded that the human tuberculous virus acts on the bovine species exactly like the tubercular virus which comes from the bovine species itself.[1]

That the diseases are not absolutely distinct is indicated by the fact that tuberculin made from human bacilli causes a reaction in cattle affected with bovine tuberculosis. The Bureau of Animal Industry has distributed hundreds of thousands of doses of tuberculin made from human bacilli, and this tuberculin has been used by State authorities in various parts of the United States for diagnosing the disease of cattle, and has been found extremely reliable and satisfactory for this purpose. This fact would clearly indicate that if there is a difference between bacilli from human and bovine sources—and your committee is inclined provisionally to admit such a difference—it consists in minor biological variations and not in the germs being specifically distinct.

In discussing the susceptibility of man to bovine tuberculosis it appears to your committee that Koch has simply begged the question.

[1] Proceedings of the Congress for the Study of Human and Animal Tuberculosis. Second Session, Paris, 1891, p. 51.

If we admit that human tuberculosis is not readily communicable to cattle, the conclusion that bovine and human tuberculosis are entirely different and not intercommunicable between these species does not necessarily follow. Another possible conclusion, and one more in harmony with what is known of comparative pathology, is that the bovine bacillus, being proved more virulent for all animals upon which it has been tried, is also more virulent for man.

As pointed out in this committee's report of last year, there is no contagion which affects so many and such widely separated species of animals as does the bovine bacillus and which is not at the same time pathogenic for man. Bovine tuberculosis is communicable to horses, cattle, sheep, swine, dogs, cats, guinea pigs, and rabbits. This is a very extensive range of pathogenic power. What other pathogenic germ is there which is virulent for so many and such widely separated species and which is not virulent also for man?

As examples of diseases which affect many species of animals we have anthrax, rabies, glanders, malignant oedema, and tetanus, to all of which mankind is susceptible. As examples of diseases which affect a fewer number of species we have epizootic aphtha, which principally affects cattle and swine, and which is communicable to man; we have vaccinia or cowpox, which affects horses and cattle and which is communicable to man; we have rinderpest which affects only ruminants, and which is not communicable to man; we have pleuro-pneumonia and Texas fever, which affect cattle and are not communicable to man; and we have sheep pox, which affects sheep only, and hog cholera, affecting swine only, which are not communicable to man. The rule appears to be—the larger the number of animal species susceptible the more likely is a contagion to affect man. Surely a germ which is pathogenic for so many species of animals as is the bovine tubercle bacillus should be considered as dangerous to man until positive evidence has proved its innocence.

We are not without parallel cases in comparative pathology which should be considered in deciding such an important question. One of these is found in rabies. When the contagion of this disease is inoculated into monkeys and passed from one animal of this species to another for a few times, the virus, as is well known, becomes so lacking in pathogenic power that it no longer produces rabies in dogs when inoculated in the usual manner. How wrong it would be to conclude that because rabies of monkeys is not communicable to the dog, conversely the rabies of the dog is not communicable to monkeys, must be apparent to all; yet this appears to be exactly the kind of assumption which Koch has made in regard to the bovine tubercle bacillus.

Another parallel case is found in variola. The variola of man, commonly called smallpox, is conveyed to cattle with much difficulty. Like human tuberculosis, it produces, when inoculated in these animals, only insignificant results when compared with the disease in man, with no tendency to generalization or to the production of fatal results, but on the other hand the tendency is to retrogression and healing. Nevertheless the bovine variola, known as vaccinia or cowpox, is easily inoculated upon man, develops to the same extent as in cattle, produces characteristic lesions, runs its regular course, and may be transferred from man to man an infinite number of times, as has been shown in the practice of vaccination. If cowpox had never been experimentally tested upon man, and we had only the results of experiments in inoculating smallpox upon cattle, we should have the same reason for concluding that vaccinia is not communicable to man that has been cited in the case of tuberculosis.

Koch alludes to two kinds of evidence available for deciding this question: First, the demonstration of cases of primary intestinal infection in man; secondly, the inoculation of cattle with bacilli found in cases of human tuberculosis.

It appears to your committee that his treatment of this question is very narrow and unsatisfactory. In deciding as to the susceptibility of man the evidence now available may be classified under four heads: 1. Accidental inoculations with bovine bacilli. 2. Clinical evidence of individuals infected with milk. 3. Statistics of abdominal tuberculosis. 4. Results of post-mortem examinations. We shall discuss the subject under these four heads.

ACCIDENTAL INOCULATIONS OF MAN WITH BOVINE BACILLI.

The first and most important line of evidence is that obtained from accidental inoculations of man with bovine bacilli. Ravenal[1] has put on record three cases of veterinarians in the State of Pennsylvania who were accidentally inoculated with bovine tuberculosis in making post-mortem examinations. Case 1 was accidentally wounded in the knuckle of his forefinger. The wound healed badly and a nodule soon formed which showed a decided tendency to ulcerate. After some weeks he had the nodule removed, and a section of the excised portion was found to contain a large giant cell, but tubercle bacilli were not satisfactorily demonstrated in the preparation. The nodule recurred after excision, and was finally cured by treatment in the hot air apparatus.

[1] Three Cases of Tuberculosis of the Skin due to Inoculation with the Bovine Tubercle Bacillus. Mazyck P. Ravenel, Philadelphia Medical Journal, July 21, 1900.

Case 2 was Ravenel's assistant, who scratched his knuckle on the broken end of a rib in performing a post-mortem on a goat which had succumbed to an experimental inoculation with a culture of bovine tubercle bacillus. The wound healed promptly, but about three weeks after became reddened, swollen and sensitive. It grew worse and was finally excised with a margin of healthy skin. Two guinea pigs were inoculated subcutaneously with a portion of this nodule, and both of these developed a generalized tuberculosis.

Case 3, a well known veterinarian of Philadelphia, wounded the knuckle of his forefinger in making an autopsy on a tuberculous cow. Between three and four weeks afterwards the scar was noticed to be enlarged, reddened, and somewhat sensitive. As it showed no tendency to improve, but rather grew worse, it was excised some six weeks after the inoculation and the wound cauterized with bromin, since which there has been no return. The nodule was examined by Dr. John Guiteras, who demonstrated its tuberculous nature by finding tubercle bacilli in sections.

L. Pfeiffer[1] cites the case of Veterinarian Moses, thirty-four years old, of healthy family and personally in good health, who pricked his left thumb in making an autopsy on a tuberculous cow. The point of the knife probably penetrated into the articulation of the first and second phalanges. The puncture healed without suppuration, but at the end of six months there formed at the seat of the cicatrix a cutaneous tubercle, and the joint was removed. Soon afterward the patient began to cough, and died of phthisis eighteen months after the accident. On opening the articulation of the thumb it was found filled with caseous masses extraordinarily rich in tubercle bacilli.

A somewhat similar case occurred in the practice of M. B. Hartzell, of Philadelphia, and was partially reported at the meeting of the American Medical Association held at Philadelphia June 1 to 4, 1897. Further details have been received through Ravenel. The patient, a man in excellent health and weighing 175 pounds, was employed by a railroad company to clean cars used for the transportation of cattle. He was wounded upon the back of the hand by a piece of broken woodwork of a car, and typical verrucous tuberculosis developed locally. This was apparently successfully treated by Hartzell. Within a year the patient's general health changed greatly; he was emaciated, had a persistent and frequent cough with abundant expectoration, and there was decided dullness at the left apex, with numerous rales. Death soon resulted from general tuberculosis.

A very interesting case of "primary subcutaneous tuberculosis" caused by the topical application of cream was reported by Grothan.[2]

[1] L. Pfeiffer, in Zeitschr. f. Hygiene, band 3, page 209, 1888.

[2] Omaha Clinic, February, 1896.

A little girl six years old had suffered from an eruption on the left leg supposed to be due to ivy poisoning. This was treated at home by the topical application of fresh cream. When seen by Grothan there was a painless ulcer of irregular shape the size of a 25-cent piece on the posterior aspect of the leg, having the characteristic appearance of a tubercular ulcer, with reddish tinged borders slightly overhanging the floor, which was covered with granulations and watery pus. There was also about a dozen light mahogany colored spots confined to the calf of the leg and the lower third of the thigh, varying from the size of a hazelnut to the one-half of a large walnut, and containing masses of caseous material. The cow was examined and the udder seemed normal, yet inguinal and intraperitoneal inoculation of two rabbits with a mixture of milk and cream gave positive results in one peritoneal and both inguinal inoculations. The caseous material from the nodules of the girl's leg injected into the peritoneum of a rabbit produced tuberculous peritonitis and death in about three weeks. The family was using milk from one cow only at the time the application was made.

A somewhat similar case was recorded by Coppez.[1] "A girl seventeen years old had a wound on the palmar aspect of the third finger between the second and third phalanx, which became infected with tubercle bacilli during milking. The original lesions gave rise, within six months, to over thirty-five subcutaneous abscesses situated in different parts of the body. There were two on the right hand, four on the elbow, two on the shoulder blade, several on the right cheek, two on the left palm, one on the back of the neck, a dozen on the buttocks and thighs, four on the left leg, three on the sole of one foot, and one on the big toe. Most of these were curetted and iodoform applied six months after the beginning of the disease. Subsequently more appeared, in all from 60 to 66. The author describes the appearance of these foci as follows:

"At a certain point, always in the neighborhood of a pre-existing focus, a thickening of the subcutaneous tissue appeared, associated with increased heat of the skin and pain on pressure. The heat soon disappeared, and a fluctuating livid tumor opened itself and discharged pus and later a yellowish serum. These various abscesses healed slowly, and within a year all disappeared. At no time could any visceral lesions be recognized, but one eye became involved. The nature of the affection was demonstrated by inserting some pus from an abscess into the eye of a rabbit. There was but slight reaction at first. Subsequently the whole eye became diseased, the lymph nodes of the neck being greatly enlarged. After several months death ensued."

1 Cited by Theobald Smith in The Journal of Experimental Medicine, III, 505, from Rev. gén. d'ophthalm., XV (1896), 433.

Tscherning of Copenhagen treated a veterinarian whose finger had been wounded in making a post-mortem examination of a tuberculous cow. Three weeks after the accident, the slight wound having already healed, the surrounding tissues became swollen, and a little later a suppurating ulcer formed. Notwithstanding an appropriate treatment the local disease became worse and it was necessary to excise all of the swollen tissue. Microscopic examination demonstrated tubercles with bacilli. The patient recovered without further development of the disease.[1]

M. T. Naughton, Chicago, Ill., has communicated to me the following case, which was observed in his practice:

G. E. W., Pole, age 34, weight 170 pounds, healthy looking man, butcher by occupation. Family history negative. Father of three healthy children. Has no recollection of having been previously sick. On May 3, 1899, while cleaning cattle viscera, he fell and a stationary meat hook, upon which hearts and lungs are hung, penetrated through the right hand between the second and third metacarpal bones. A tendo-vaginitis resulted with some lymphangitis of the arm. He received the usual treatment for an infected wound and apparently made a good recovery, with, however, some limited motion of the fingers, and a sensitive scar at the site of puncture. Four months afterwards an abscess formed in the axilla, which was cleaned out and tubercle bacilli were demonstrated in the broken down gland tissue. At this time there was no soreness in the arm lymphatics or elbow gland, but he complained that there had been. In three months afterwards or seven months from the original accident he died from pulmonary tuberculosis.

These are very clear cases, and could be multiplied if necessary to add strength to the evidence. These cases demonstrate the susceptibility of man to infection by bovine bacilli inoculated into the skin or subcutaneously. Not only were local lesions produced, but in some cases the disease was generalized and ended in death. The value of such cases of inoculation in demonstrating the susceptibility of man has been questioned on the ground that the lesions resulting from inoculation of the skin are usually slight and remain localized. While it is true they remain localized in most cases, they have sometimes been attended by fatal results, and in all cases appear to be at least as serious as similar inoculations with the human bacillus. The human bacillus is known to be pathogenic for man, and it causes one of the most fatal of human diseases. Now if the bovine bacillus when inoculated in the skin produces at least as serious results as the human bacillus, we have

[1] Proceedings Congress for the Study of Human and Animal Tuberculosis, First session, Paris, 1888, p. 275.

a right to conclude that mankind is equally susceptible to the bovine as to the human form of contagion.

It is reported that one of the foreign delegates said in the British Congress that the inoculation of man from animals is a different thing from infection by way of the alimentary tract. While this may be admitted, it is nevertheless true that the human bacillus, which may infect man by way of the alimentary tract, is only inoculated in the skin with difficulty, as is shown by the insignificant lesions which usually follow inoculations in making autopsies and dissections. In other words, the alimentary tract appears to be a more favorable route of entrance for the human bacillus than is the skin; and consequently if the bovine bacillus is able to enter the body by means of skin inoculations, there is every reason to believe that it may also enter by way of the alimentary tract.

These very clear cases appear to demonstrate the communicability of bovine tuberculosis to man and to indicate that the bacilli from a bovine source are at least as virulent for man as are bacilli from a human subject. It will not do to put these cases aside, saying that such inoculations are another matter from intestinal infection, because the great point to be decided is the susceptibility of man to the bovine bacillus, and it will be observed that Koch proposes in testing the virulence of bacilli from the human subject to do this by subcutaneous inoculations in cattle. If such inoculations are a proper test of susceptibility in the one case, why are they not equally so in the other?

TUBERCULOSIS IN MAN BELIEVED TO HAVE BEEN CAUSED BY INGESTION OF MILK FROM TUBERCULOUS COWS.

The second class of evidence to which your committee would refer is the clinical observation of individuals infected by the ingestion of milk. One of these frequently cited is a case reported by Ollivier to the Paris Academy of Medicine.[1] Twelve girls contracted tuberculosis in a young ladies' boarding school. Of these five died. From the fact that the sick and deceased girls were descended from healthy ancestors and above all doubt showed the phenomena of intestinal tuberculosis, there was suspicion of infection with the food. Full confirmation of this suspicion was found in the slaughter of a cow which for a year had served as a source of milk supply for the school. The cow had extensive tuberculosis of the intestines and udder. This case has particular value because of the number of persons affected, the fact that they had intestinal tuberculosis, and the demonstration of udder tuberculosis in the cow.

1 Ostertag, Handbuch der Fleischbeschau, page 638.

Another case is cited by T. Percy C. Kirkpatrick.[1] This was the case of a daughter of a Dr. Gosse, of Geneva, reported by himself. The girl up to the age of seventeen had been quite healthy and had no history of hereditary taint or predisposition to tuberculosis. Early in 1893 she became ill with more or less vague and undefined symptoms, and died in some ten months. Gosse performed a post-mortem examination and discovered extensive tuberculosis of the mesenteric glands and abdominal viscera. When trying to find the source of infection in this case Gosse's attention was drawn to a small farm which he possessed in the country which he had been accustomed to visit on Sundays with his daughter, and one of her chief delights was to drink milk from the cows there. On examination, four of the five cows were tubercular, and two had disease of the udder.

An interesting case was under the care of Dr. Thomas M. Rotch in the Children's Hospital in Boston in 1893 or 1894. The particulars were sent to Dr. de Schweinitz, of the Bureau of Animal Industry, by Dr. Rotch. A boy seven years old had been drinking a great deal of milk from one cow for about four months before entering the hospital. The cow was found to be tuberculous, the disease being demonstrated by autopsy. The boy was a case of primary tubercular peritonitis with effusion. Laparotomy was performed by Dr. Bradford, and a large amount of serous fluid evacuated. The peritoneum was found to be thickly studded with minute tubercles, and the presence of tubercle bacilli was demonstrated. Four years after the operation the boy was found to be perfectly well and seemed free from tuberculosis.

Lydtin gives the following case:[1] Dr. Stang, of Amorbach, was called to a finely developed five-year-old boy, the son of healthy parents with no hereditary taint in their ancestors. The boy died a few weeks later with miliary tuberculosis of the lungs and enormously enlarged tubercular mesenteric glands. At the necropsy it was learned that the boy had habitually drank the milk of a cow, which had been killed shortly before he died, and which had shown pulmonary tuberculosis.

Mr. Howe, of North Hadley, Mass., lost a son twenty months old from abdominal tuberculosis, three months after he paid a week's visit to his uncle and had been fed with milk of the uncle's cow. The cow was killed soon after and shown to have generalized tuberculosis. The child's sickness and wasting began a few weeks after he returned home.

[1] Dublin Journal of Medical Science, 1897, n. s., vol. 103, pp. 378-386. Also cited by Nocard, Les Tuberculoses Animales, p. 124.

[1] Cited by Law from Report of Veterinary Congress at Brussels, 1883, page 288. Also cited by Nocard from Compte-Rendu of Fourth International Veterinary Congress, Brussels, 1883, page 188.

He had previously been strong and healthy, as were and are his parents.[1]

A four-year-old son of Col. Beecher, of Yonkers, and grandson of Henry Ward Beecher, died March 4, 1894, of tubercular meningitis, and the two Alderney cows which supplied him milk were proved tuberculous by the tuberculin test and post-mortem examination. There was no hereditary taint.[2]

A Scotch family, strong and healthy, had a herd of cows which contracted tuberculosis. Two young daughters brought up on the milk died of tuberculosis, while the two older brothers, using little or no milk, remained well and hardy.[3]

Dr. Demme, chief physician of the Children's Hospital, Berne, records the cases of four children, born of healthy parents and without tuberculous ancestors either on the paternal or maternal side, who died of intestinal and mesenteric tuberculosis, having consumed for some time milk furnished by tuberculous cows. Among 2,000 tuberculous children treated by Dr. Demme in twenty years, these were the only ones in which he could absolutely exclude the possibility of hereditary taint and all other causes of the disease except the infected milk.[4]

Von Ruck records the following case which he considers almost conclusive:[5]

M., age 33, weight 180 pounds, was treated by his family physician about six weeks for what was supposed to be typhoid fever. Growing worse when convalescence was looked for, Von Ruck was called in consultation. Diagnosis of acute miliary tuberculosis was soon established. The autopsy showed the usual dissemination of the tubercular process but no old focus was found in chest or abdomen, which only were permitted to be examined. Family and personal history good and the source and mode of infection remained for the time obscure.

A few days after M's death, Von Ruck was called to see his nearly one-year-old child on account of fever and diarrhoea, which yielded to treatment, but the child did not recover its former good health. Gradually symptoms of meningitis developed and the child died. No post-mortem was permitted, but there was no doubt of the tubercular character of the meningitis. Infection from father was not probable, the child having been removed from the house at an early period of his illness.

1 Cited by Law, Papers and Addresses, New York State Veterinary College, 1896 to 1898, page 85.

2 Loc. cit.

3 Law, loc. cit., page 96, from Tuberculosis, National Veterinary Association, London, 1883.

4 Nocard, Les Tuberculoses Animales, page 123.

5 Journal of Tuberculosis, Apr. 1899, page 64.

The milk which the child had received came from a Jersey cow and no other had been used up to the time the diet was changed on account of the diarrhœal attack. The father had drank largely of this cow's milk, taking a pint and sometimes a quart twice a day, warm at the time of milking, and this cow's milk was given him exclusively during his entire illness. On examination, one of the cow's teats was found to be shrunken, it was said to yield little milk and several months before, the milk from this teat was occasionally bloody. There was a hard irregular lump on the same side of the udder. When the cow was killed several months later, there was found extensive tuberculosis in the lungs and peritoneal cavity, and the lump in the udder contained a caseous center, which on examination, showed numerous, well-stained tubercle bacilli.

These are examples of clinical evidence which might be greatly extended, but all are of course open to the objection that we do not know absolutely that the disease was caused by the bovine bacillus. However, the occurrence of abdominal tuberculosis soon after the use of milk from tuberculous cows is a coincidence which justifies us in accepting the cases as strong circumstantial evidence, not of themselves demonstrating the communicability of bovine tuberculosis, but taken with other evidence, making a case which it is difficult to contest.

STATISTICS SHOWING FREQUENCY OF ABDOMINAL TUBERCULOSIS.

The third line of evidence to which we invite attention is the statistical data available from various parts of the world.

Thorne, in the Harben Lectures for 1898, shows from the statistics of England and Wales that between the periods 1851-1860 and 1891-1895 there has been a reduction of the mortality at all ages from phthisis of 45.4 per cent., while from all forms of tuberculosis the reduction has been distinctly less, namely, 39.1 per cent. Taking that form of disease registered under the name of "tabes mesenterica," the reduction at all ages has been but 8.5 per cent.; under five years of age the reduction has been but 3 per cent., while under one year of age there has been an actual increase of 27.7 per cent. This is the milk-drinking age, and the increase of the mortality is very significant at a time when phthisis has been so remarkably reduced. So instructive are these statistics that we reproduce here Thorne's table showing the mortality from this disease.

ENGLAND AND WALES.—MORTALITY FROM TABES MESENTERICA, IN SEVERAL PERIODS, 1851-1895.

PERIOD.	Per Million Living.	Per Million Births.	Per Million Living.
	All ages.	Under 1 yr.	Under 5 yrs.
1851–1860	260	3,169	1,625
1861–1870	295	3,800	1,856
1871–1880	318	4,467	2,028
1881–1885	289	4,356	1,852
1886–1890	265	4,462	1,764
1891–1895	238	4,046	1,577
Reduction or increase per cent. between 1851-1860 and 1891-1895.	—8.5	+27.7	—3.0

The conclusions which naturally follow from these statistics are so different from the opinions of many men that numerous attempts have been made to counteract them. Some have held that the cases returned under "tabes mesenterica" could not be relied upon as abdominal tuberculosis. An examination of the evidence presented leads your committee to the conclusion that this point is not well taken.

Still[1] has recorded the results of 769 autopsies on children under twelve years of age at the Hospital for Sick Children, Great Ormonde Street. Two hundred and sixty-nine cases were found showing tuberculous lesions. In those in which the channel of infection could be made out with some certainty, the primary infection was: lung, 105; intestine, 53; ear, 9; bones or joints, 5. That is, the intestinal infections were to the others as 1 to 2.1. With the class of cases where death was caused by some other disease and where tuberculosis was either arrested in an early stage or had not progressed beyond the initial stage, affording almost indisputable evidence of the method of infection, the infections were: by the lung, 26; by the intestine, 16; by the ear, 1. Here the intestinal infections were to the others as 1 to 1.7. In the English statistics the cases of tabes mesenterica in children of five years and under are to the other forms of tuberculosis as 1

1 British Medical Journal, Aug. 19, 1899, page, 455.

to 1.6. Still's observations are therefore a singular indorsement of the accuracy of the returns under the name of tabes mesenterica, and as the ages of the children covered by his autopsies were twelve years and under, he has really found a larger percentage of intestinal infection than is indicated by the statistics.

J. Walter Carr also referred to statistics of necropsies on tuberculous children at the Victoria Hospital.[1] He found 79 in which the disease most probably started in the chest, and 20 in which it seemed to have begun in the abdomen. Here the relation between the two forms of infection is 1 to 4. In 26 children with early or limited tuberculosis the thorax was alone affected in 12 cases, the abdomen in 7, being in the proportion of 1 to 1.7. Of 53 tuberculous children under two years of age the disease most probably began in the chest in 43, and in only 5 certainly in the abdomen, the proportion in this case being as 1 to 8.4. Out of 25 children over five years of age the disease began in the chest in 12, in the abdomen in 6, the relation being as 1 to 2.

Shennan[2] collected data from post-mortem examinations at the Royal Hospital for Sick Children, Edinburgh, of 355 cases of tuberculosis, in 331 of which he was able to determine the channel of infection. In 67.7 per cent. this was respiratory, in 28.1 per cent. it was alimentary. This is as 1 to 2.3.

These post-mortem examinations, all from English sources, may be accepted as fairly representative of the results of the post-mortem room, and they sustain Thorne's contention that the returns in England of tabes mesenterica represent with reasonable accuracy the abdominal tuberculosis of children in that country. It may be added that in Still's most recent paper[3] he states that "it would seem, therefore, that at any rate amongst hospital patients in London nearly one-third of the child mortality is due to tuberculosis; and although such an estimate may, for various reasons, be too high when applied to the whole child mortality of this city, is seems almost certain that the average given by the Registrar-General's statistics is far too low. During the five years, 1891 to 1895, the average number of deaths per annum from all causes amongst children up to the age of ten years in this city was 36,349; out of these the average number of children certified each year as having died of tuberculosis was 3,335. The evidence of post-mortem statistics makes it practically certain that a very much larger number

[1] British Medical Journal, Sept. 2, 1899, page 626.

[2] Edinburgh Hospital Reports, 1900. Cited by Still in The Practitioner, July, 1901.

[3] The Practitioner, July, 1901.

than this died of tuberculous disease, and probably we should be well within the mark if we said that at least 6,000 children die every year in London alone from tuberculosis." This being the case, and the proportion between tabes mesenterica and other forms of tuberculosis remaining the same, there must have been nearly twice as many cases of intestinal tuberculosis in London as were recorded by the Registrar-General; but as tabes mesenterica is one of the most obscure forms of the disease, the probability is that more children affected with this form of tuberculosis were otherwise reported than was the case with phthisis, tubercular meningitis and other forms of tuberculosis that were more easily diagnosed. At any rate it may be accepted as certain that the evidence so far presented has sustained Thorne's conclusions in regard to tabes mesenterica. This being the case, your committee deems it advisable to introduce at this point the statistics of England and Scotland and some of the principal cities of the world showing deaths from different forms of tuberculosis.

DEATHS FROM TUBERCULOUS DISEASES, ENGLAND AND WALES, FOR THE YEAR 1898.

(Population 31,397,078.)

	Under 1 yr.	Under 5 yrs.	Under 10 yrs.	Under 15 yrs.	Under 20 yrs.	Under 25 yrs.	Under 35 yrs.	All ages.
Tabes mesenterica	3,265	5,050	5,369	5,555	5,725	5,850	6,050	6,357
Tubercular meningitis (Acute hydrocephalus)	1,985	4,904	5,791	6,147	6,339	6,451	6,573	6,681
Other forms of tuberculosis, scrofula	1,319	2,585	3,035	3,399	3,851	4,233	4,807	5,766
Total other than phthisis	6,569	12,539	14,195	15,101	15,915	16,534	17,430	18,804
Phthisis	493	1,491	2,126	3,127	6,437	11,212	21,007	41,335
Total tuberculosis	7,062	14,030	16,321	18,228	22,352	27,746	38,437	60,139

DEATHS FROM TUBERCULOUS DISEASES IN SCOTLAND FOR THE YEAR 1898.

(Population 4,249,946.)

	Under 1 yr.	Under 15 yrs.	Under 25 yrs.	All ages.
Tabes mesenterica	239	788	872	947
Tubercular meningitis	350	1,212	1,263	1,288
Other forms of tuberculosis, scrofula	121	459	605	815
Total other than phthisis	710	2,459	2,740	3,050
Phthisis	78	720	2,675	7,090
Total tuberculosis	788	3,179	5,415	10,140

DEATHS FROM TUBERCULOUS DISEASES IN LONDON FOR THE YEAR 1898.

(Estimated Population, 4,504,766.)

	Under 1 yr.	Under 5 yrs.	Under 10 yrs.	Under 15 yrs.	Under 20 yrs.	Under 25 yrs.	Under 35 yrs.	All ages.
Tabes mesenterica.....	602	838	884	903	915	930	958	997
Tubercular meningitis....	397	989	1,128	1,177	1,197	1,213	1,232	1,250
Other forms of tuberculosis, scrofula	285	555	639	693	750	791	865	983
Total other than phthisis.	1,284	2,382	2,651	2,773	2,862	2,934	3,055	3,230
Phthisis	98	308	385	496	851	1,517	3,272	7,812
Total tuberculosis	1,382	2,690	3,036	3,269	3,713	4,451	6,327	11,042

DEATHS FROM TUBERCULOUS DISEASES IN BERLIN FOR THE YEAR 1898.

(Population, June 30, 1,768,624.)

	Under 1 yr.	Under 5 yrs.	Under 10 yrs.	Under 15 yrs.	Under 20 yrs.	Under 25 yrs.	Under 35 yrs.	All ages.
Tabes mesenterica	4	14	23	29	30	35	45	71
Tubercular meningitis....	39	163	196	205	210	216	225	237
Other forms of tuberculosis, scrofula	20	34	38	40	40	47	62	88
Total other than phthisis .	63	211	257	274	280	298	332	396
Phthisis	78	246	300	360	559	983	1,867	3,553
Total tuberculosis	141	457	557	634	839	1,281	2,199	3,949

DEATHS FROM TUBERCULOUS DISEASES IN PARIS FOR THE YEAR 1897.

(Population, 1896, 2,511,629.)

	Under 1 yr.	Under 5 yrs.	Under 10 yrs.	Under 15 yrs.	Under 20 yrs.	Under 25 yrs.	Under 35 yrs	All ages.
Tabes mesenterica	4	21	34	47	55	61	83	154
Tubercular meningitis....	140	633	802	837	857	892	943	999
Other forms of tuberculosis, scrofula	50	143	174	196	248	346	567	1,168
Total other than phthisis.	194	797	1,010	1,080	1 160	1,299	1,593	2,321
Phthisis	48	244	325	456	1,038	1,955	4,296	9,298
Total tuberculosis	242	1,041	1,335	1,536	2,198	3,254	5,889	11,619

DEATHS FROM TUBERCULOUS DISEASES IN NEW YORK CITY FOR THE YEAR 1899.

(Estimated Population, 3,550,053.)

	Under 1 yr.	Under 5 yrs.	Under 10 yrs.	Under 15 yrs.	Under 20 yrs.	Under 25 yrs.	Under 35 yrs.	All ages.
Tabes mesenterica	34	40	40	40	40	40	42	45
Tubercular meningitis ...	281	676	750	766	781	795	819	864
Other forms of tuberculosis, scrofula.....	79	175	211	233	272	328	437	613
Total other than phthisis .	394	891	1,001	1,039	1,093	1,163	1,298	1,522
Phthisis	98	220	269	362	778	1,751	4,316	8,015
Total tuberculosis	492	1,111	1,270	1,401	1,871	2,914	5,614	9,537

DEATHS FROM TUBERCULOUS DISEASES IN BOSTON FOR THE YEAR 1900.

(Population, 560,892.)

	Under 1 yr.	Under 15 yrs.	Under 25 yrs.	All ages.
Tabes mesenterica	2	10	12	18
Tubercular meningitis	43	117	123	131
Other forms of tuberculosis, scrofula	20	51	79	181
Total other than phthisis	65	178	214	330
Phthisis	11	52	318	1,247
Total tuberculosis	76	230	532	1,577

DEATHS FROM TUBERCULOUS DISEASES IN CHICAGO FOR THE YEARS 1897 and 1898.

(Population, 1897, 1,619,226; 1898, 1,650,000.)

	Under 1 yr.	Under 5 yrs.	Under 10 yrs.	Under 20 yrs.	Under 30 yrs.	All ages.
Tuberculosis, mesenteric (1897) and peritoneal (1898)	3	12	16	29	36	56
Tuberculosis, cerebral	75	190	225	249	270	293
" other organs	40	88	110	158	248	460
Total other than phthisis	118	290	351	436	554	809
Phthisis	66	196	250	700	2,061	4,596
Total tuberculosis	184	486	601	1,136	2,615	5,405

It is evident from these tables that abdominal tuberculosis is a very common disease in England, Wales and Scotland, and that it is by no means unknown in the cities of Berlin, Paris, New York, Boston and Chicago.

To show more clearly the numerical relation of the different forms of tuberculosis, a series of tables of percentages have been compiled, corresponding with those just given showing the number of deaths.

DEATHS FROM TUBERCULOSIS IN ENGLAND AND WALES FOR THE YEAR 1898.

PERCENTAGE OF EACH FORM.

	Under 1 yr.	Under 5 yrs.	Under 10 yrs.	Under 15 yrs.	Under 20 yrs.	Under 25 yrs.	Under 35 yrs.	All ages.
Tabes mesenterica	46.23	36.00	32.90	30.48	25.61	21.08	15.74	10.57
Tubercular meningitis (Acute hydrocephalus)	28.11	34.95	35.48	33.72	28.36	23.25	17.10	11.11
Other forms of tuberculosis, scrofula	18.68	18.42	18.59	18.65	17.23	15.26	12.51	9.59
Phthisis	6.98	10.63	13.03	17.15	28.80	40.41	54.65	68.73
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

DEATHS FROM TUBERCULOSIS IN SCOTLAND FOR THE YEAR 1898.

PERCENTAGE OF EACH FORM.

	Under 1 yr.	Under 15 yrs.	Under 25 yrs.	All ages.
Tabes mesenterica	30.33	24.79	16.10	9.34
Tubercular meningitis	44.42	38.13	23.33	12.70
Other forms of tuberculosis, scrofula	15.36	14.44	11.17	8.04
Phthisis	9.89	22.64	49.40	69.92
Total	100.00	100.00	100.00	100.00

DEATHS FROM TUBERCULOSIS IN LONDON FOR THE YEAR 1898.

PERCENTAGE OF EACH FORM.

	Under 1 yr.	Under 15 yrs.	Under 25 yrs.	All ages.
Tabes mesenterica	43.56	27.62	20.89	9.03
Tubercular meningitis....	28.72	36.01	27.26	11.32
Other forms of tuberculosis, scrofula.....	20.63	21.20	17.77	8.90
Phthisis	7.09	15.17	34.08	70.75
Total	100.00	100.00	100.00	100.00

DEATHS FROM TUBERCULOSIS IN BERLIN FOR THE YEAR 1898.

PERCENTAGE OF EACH FORM.

	Under 1 yr.	Under 15 yrs.	Under 25 yrs.	All ages.
Tabes mesenterica	2 84	4.57	2.73	1.80
Tubercular meningitis....	27.66	32.33	16.86	6.00
Other forms of tuberculosis, scrofula	14.18	6.31	3.67	2.23
Phthisis	55.32	56.79	76.74	89.97
Total	100.00	100.00	100.00	100.00

DEATHS FROM TUBERCULOSIS IN PARIS FOR THE YEAR 1897.

PERCENTAGE OF EACH FORM.

	Under 1 yr.	Under 15 yrs.	Under 25 yrs.	All ages.
Tabes mesenterica	1.65	3.06	1.87	1.33
Tubercular meningitis....	57.85	54.49	27.42	8.60
Other forms of tuberculosis, scrofula.....	20.66	12.76	10.63	10.05
Phthisis	19.84	29.69	60.08	80.02
Total	100.00	100.00	100.00	100.00

DEATHS FROM TUBERCULOSIS IN NEW YORK FOR THE YEAR 1899.

PERCENTAGE OF EACH FORM.

	Under 1 yr.	Under 15 yrs	Under 25 yrs.	All ages.
Tabes mesenterica	6.91	2.86	1.37	0.47
Tubercular meningitis....	57.11	54.68	27.28	9.06
Other forms of tuberculosis, scrofula.....	16.06	16.62	11.25	6.43
Phthisis	19.92	25.84	60.10	84.04
Total	100.00	100.00	100.00	100.00

DEATHS FROM TUBERCULOSIS IN BOSTON FOR THE YEAR 1900.

PERCENTAGE OF EACH FORM.

	Under 1 yr.	Under 15 yrs.	Under 25 yrs.	All ages.
Tabes mesenterica	2.63	4.35	2.26	1.14
Tubercular meningitis....	56.58	50.87	23.12	8.31
Other forms of tuberculosis, scrofula	26.32	22.17	14.85	11.48
Phthisis	14.47	22.61	59.77	79.07
Total	100.00	100.00	100.00	100.00

DEATHS FROM TUBERCULOSIS IN CHICAGO FOR THE YEARS 1897 AND 1898

PERCENTAGE OF EACH FORM.

	Under 1 yr.	Under 5 yrs.	Under 10 yrs.	Under 20 yrs.	Under 30 yrs.	All ages.
Tuberculosis, mesenteric, (1897) and peritoneal (1898)	1.63	2.47	2.66	2.55	1.38	1.04
Tuberculosis, cerebral....	40.76	39.09	37.44	21.92	10.33	5.42
" other organs	21.74	18.11	18.30	13.91	9.48	8.51
Phthisis	35.87	40.33	41.60	61.62	78.81	85.03
Total	100.00	100.00	100.00	100.00	100.00	100.00

(In these tables, the term tabes mesenterica is believed to cover tuberculosis of the intestines, peritoneum and abdominal lymphatic glands.)

Taking England and Wales, it is seen that in children under one year old tabes mesenterica constitutes 46.23 per cent. of the total cases of tuberculosis at that age, while phthisis constitutes but 6.98 per cent. Under five years the figures are 36 per cent. for tabes mesenterica and 10.63 per cent. for phthisis. It is not until the age of twenty years is reached that the percentage of phthisis exceeds that of tabes mesenterica. In Berlin, Paris, New York, Boston and Chicago the statistics, however, are quite different and the number of cases of abdominal tuberculosis returned is very much smaller.

Your committee has added a table compiled from these statistics showing the deaths per million population from the different forms of tuberculosis in England, Wales and Scotland, and in the cities mentioned. From this table the extreme frequency of intestinal tuberculosis in England and Scotland is made manifest.

DEATHS PER MILLION POPULATION FROM DIFFERENT FORMS OF TUBERCULOSIS.

	England and Wales, 1898	Scotland, 1898	London, 1898	Berlin, 1898	Paris, 1897	New York, 1899	Boston, 1900	Chicago, 1897-'98
Under 1 year.								
Tabes mesenterica	104	56	134	2	2	10	4	1
Tubercular meningitis	63	82	88	22	56	79	77	23
Other forms of tuberculosis, scrofula	42	29	63	11	20	22	35	12
Phthisis	16	18	22	44	19	28	20	20
Total tuberculosis	225	185	307	79	97	139	136	56
Under 15 years.								*Under 20.*
Tabes mesenterica	177	185	200	16	19	11	18	9
Tubercular meningitis	196	285	261	116	333	216	209	76
Other forms of tuberculosis, scrofula	108	108	154	23	78	66	91	48
Phthisis	100	169	110	203	182	102	93	214
Total tuberculosis	581	747	725	358	612	395	411	347
Under 25 years.								*Under 30.*
Tabes mesenterica	186	205	206	20	24	11	21	11
Tubercular meningitis	205	297	269	122	355	224	219	83
Other forms of tuberculosis, scrofula	135	142	176	26	138	92	141	76
Phthisis	357	629	337	556	778	493	567	630
Total tuberculosis	883	1,274	988	724	1,295	820	948	800
All ages.								
Tabes mesenterica	202	223	221	40	61	13	32	17
Tubercular meningitis	213	303	278	134	398	243	234	90
Other forms of tuberculosis, scrofula	184	192	218	50	465	173	322	141
Phthisis	1,317	1,668	1,734	2,009	3,702	2,258	2,223	1,406
Total tuberculosis	1,916	2,386	2,451	2,233	4,626	2,687	2,811	1,654

The one point which it is desired to impress at this time is the fact that abdominal tuberculosis is not so rare that it can be properly ignored, and that the statistics of some countries show a remarkable number of cases.

POST-MORTEM EXAMINATIONS SHOWING INTESTINAL TUBERCULOSIS.

The fourth line of evidence bearing upon this question is obtained from post-mortem examinations.

Koch says that among many cases of tuberculosis examined after death he remembered having seen primary tuberculosis of the intestine only twice. Among the great post-mortem material of the Charité Hospital in Berlin, 10 cases of primary tuberculosis of the intestine occurred in five years. Among 933 cases of tuberculosis in children at the Emperor and Empress Frederick's Hospital for Children, Baginsky never found tuberculosis of the intestines without simultaneous disease of the lungs and the bronchial glands. Among 3,104 post-mortems of tubercular children Biedert observed only 16 cases of primary tuberculosis of the intestine.

Are these selected statistics, or are the results of post-mortems in Germany so different from what they are in England?

In 269 autopsies of tuberculous children Still determined the channel of infection with some degree of certainty in 216 cases, and in 63 of these primary infection was probably through the intestine.[1] Carr, in a series of 120 autopsies on tuberculous children at the Chelsea Children's Hospital, found 16.7 per cent. showed evidence of primary abdominal infection.[2] Guthrie, at the Paddington Green Children's Hospital, in a series of 77 cases, found evidence of primary intestinal infection in 19 cases.[3] Shennan collected 355 cases of tuberculosis from the post-mortems at the Royal Hospital for Sick Children, Edinburgh, in 331 of which he was able to determine the channel of infection. In 28.1 per cent. of these cases it was alimentary.[4] Bollinger, in his address at the International Tuberculosis Congress at Berlin in 1899, quoted with approval the autopsies by Keller (Kiel) of 248 tuberculous children which showed in 45.5 per cent. of the cases tuberculosis of the mesenteric glands. From these it was concluded that milk played a leading role in the so-called transmitted tuberculosis of children.

Northrup[5] refers to 125 post-mortems at the New York Foundling Asylum on tuberculous children, in 34 of which the bronchial nodes

[1] The Practitioner, July, 1901.

[2] Quoted by Still from Transactions of Medical Society of London, 1894, page 292.

[3] Quoted by Still from the Lancet, 1899, vol. I, p. 286.

[4] Edinburgh Hospital Reports, 1900. New York Medical Journal, Feb. 21, 1891. Cited by Dr. Still in The Practitioner, July, 1901.

[5] New York Medical Journal, Feb. 21, 1891. Tuberculosis in Children.

were large and cheesy, likewise the mesenteric nodes; the lungs contained tubercles, as did the liver, spleen, kidneys and meninges. The primary seat of infection in these was not clear. In the remaining 91, three were primarily of mesenteric lymph node infection, and eighty-eight were primarily of bronchial node infection.

G. Sims Woodhead, in 1894, writing on channels of infection in tuberculosis,[1] said: "I have seen in case after case in children, and in animals fed on tuberculous material, the lungs markedly affected, but in a large proportion of these cases it has been possible to trace the course of invasion back from an old caseous or calcareous mesenteric gland, through the chain of retroperitoneal glands, up through the diaphram to the posterior mediastinal and bronchial glands, and so on to the lung. I have not seen this in a few cases only, but in dozens of children, in a few adults, and in many animals."

Sheridan Delepine, proctor professor of pathology, Owens College, in a lecture on tuberculosis and the milk supply, said:[2] "A very striking proof of the frequency of infection through the intestine fell under my notice six years ago. Dr. Simcock was investigating in my laboratory the pathology of chronic wasting of children due to improper feeding. He selected 13 cases out of many more in which there was no evidence of tuberculosis in the parents or in the various organs of the children as examined in the post-mortem room. He considered these cases free from tuberculosis. I was not, however, quite convinced. We carefully examined the mesenteric glands of all these children with the object of discovering whether some might not be tuberculous. In two of these cases the mesenteric glands showed clear tuberculous lesions under the microscope, and in five more the mesenteric glands presented lesions suggesting the possibility of incipient tuberculosis. The presence of two clear cases of tuberculosis among thirteen cases carefully selected as free from tuberculosis is specially significant."

These quotations are sufficient to make it clear that primary intestinal infection is much more frequent than is indicated by Koch's paper. After expressing himself "that a case of tuberculosis has been caused by alimenta can be assumed with certainty only when the intestine suffers first, i. e., when a so-called primary tuberculosis of the intestine is found," he first endeavors to show that such cases are extremely rare, and then proceeds to contradict his first assertion that it can be assumed with certainty to have been caused by alimenta, by saying "it is by no means certain that such cases are due to infection by bovine tuberculosis, it being just as likely that they were caused by the widely

1 Lancet, vol. 2, 1894. pages 957-960.
2 Lancet, London, Sept. 17, 1898, page 733.

propagated bacilli of human tuberculosis which may have got into the digestive canal by some way or other, for instance, by swallowing saliva of the mouth."

It is clear that dust and bacilli inhaled with the air are deposited upon the mucous membrane of the nose, pharynx and trachea, and that such inhaled particles must be swallowed unconsciously, as pointed out by Lord Lister in his letter to the British Medical Journal, (August 3, 1901); also that persons infected with pulmonary tuberculosis swallow enormous numbers of bacilli. Still it is known from post-mortem examinations that pulmonary tuberculosis is more common than intestinal, and that a considerable proportion—placed by Lord Lister at one-third—of the people who die of pulmonary tuberculosis escape intestinal infection, although they are proved susceptible and have passed into their stomachs great quantities of bacilli daily for months or years. What is the explanation of this? With even the inhaled bacilli more likely to follow the digestive than the respiratory tract, why is not intestinal tuberculosis much more common than the pulmonary form?

Writers have attempted to explain this by supposing that the intestine is an unfavorable position for the bacilli to gain entrance to the tissues. Judging by the ease with which animals are infected by bovine bacilli through the digestive tract, this explanation is hardly tenable. It would appear rather that the true cause of the phenomenon is the lack of pathogenic power in the human bacillus, which has been shown experimentally on animals, and that this lack of virulence makes it difficult for human bacilli to withstand the gastric juice and other unfavorable conditions and have sufficient activity remaining to infect the body after reaching the intestine. On the other hand, the more virulent bovine germ would be more likely to maintain its activity and would be more apt to produce infection with a smaller number of germs.

The fact is that in some countries intestinal tuberculosis is comparatively rare, even with children. The statistics of Berlin, Paris, New York, Boston and Chicago prove this, although pulmonary tuberculosis is very prevalent. Surely the air and the habitations of these places must contain a maximum number of bacilli from the human disease. If intestinal tuberculosis is caused by such human bacilli, either inhaled or taken into the mouth in other ways, why is there not as much intestinal tuberculosis in those cities as in England and Scotland? Are British babies the only ones that swallow the inhaled bacilli? How can we explain the occurrence of 134 cases of tabes mesenterica per million inhabitants in children, under one year, in London, as against only two cases in Paris, when there are more than

twice as many cases of pulmonary tuberculosis per million inhabitants in Paris as in London? We see here, as in the statistics brought forward by Thorne, that there is no relation between intestinal tuberculosis and pulmonary tuberculosis; in other words, that infection by human bacilli apparently plays a very subordinate part in the causation of primary tuberculosis of the abdominal organs. This conclusion we think is legitimate and clearly follows from the statistics presented.

Why is tabes mesenterica so prevalent in Great Britain? It is a question which can only be answered properly by careful inquiry in that country. Tuberculosis is very common among the cattle there, but possibly not more so than on the continent. More attention, appears, however to be given to the inspection of meat in Berlin and Paris than in London, and possibly the same may be true of milk. Meat is more frequently eaten underdone in London, and milk is probably less frequently sterilized. In the United States we have far less tuberculosis among cattle, and also an efficient federal meat inspection; our milch cows do not show more than one-tenth, and our beef cattle not more than one-hundredth of the tuberculosis which is found in Great Britain.

Before closing, your committee desires to call attention to the fact that infection of the lungs is not always the result of inhaled bacilli. There is apparently as much opportunity for bacilli taken with the food to infect the pharyngeal, tracheal, bronchial, and mediastinal glands and the lungs as there is for inhaled bacilli to infect the intestine. When all cases of pulmonary tuberculosis are cited as necessarily due to inhaled bacilli and as not by any possibility due to infection with the food, an error is committed.

Woodhead several years ago pointed out how frequently bacilli gained entrance through the lymphoid tissue of the tonsil, and St. Clair Thomson has recently expressed the opinion that all germs are deposited before the air reaches the larynx and that infection most probably occurs through the lymphoid tissue of the naso-pharynx and pharynx. He says: "There appears to be no justification for the generally accepted idea that the bacillus is inhaled directly into the pulmonary alveoli.[1]

Sims Woodhead says of infection through the pharynx: "In many of these cases the process can be traced from the glands in the tonsil down into the neck and so on to the thorax by the mediastinal and poststernal glands and by the intercostal lymphatics and glands, and it is interesting in such cases to note how the lungs may be perfectly healthy until the glands at their root or in the pleura have become distinctly affected." Again he says: "We have also an example of

[1] The Practitioner, July, 1901.

secondary affection of the lungs following tubercle of the pharyngeal tonsillar structures, through the glands in the neck, then those in the thorax, and finally to the lung itself, in the examples that have already been given in the infection of the pig by tuberculous milk, etc. Moreover, I have seen a similar line of invasion in children."[1]

Koch tells us that in an experiment in which sputum was fed to six pigs there was no trace of tuberculosis found post-mortem "except here and there little nodules in the lymphatic glands of the neck, and in one case a few gray nodules in the lungs." It appears, then, that he did get some infection in pigs by feeding human sputum, and that the lesions, far from being in the intestines, were in the neck and lungs.

Referring to the pigs which had eaten bacilli of bovine tuberculosis, Koch says, they "had, without exception, severe tubercular diseases, especially tubercular infiltration of the greatly enlarged lymphatic glands of the neck and of the mesenteric glands, and, also, extensive tuberculosis of the lungs and spleen." There is nothing said about primary tuberculous lesions of the intestines, and we are forced to the conclusion that his own post-mortem notes do not sustain his contention that such lesions are essential in cases of infection through contaminated food. Lord Lister is said to have pointed out in his reply to Koch that if primary intestinal tuberculosis were rare in children, mesenteric tuberculosis was common, and said that the interpretation seemed to him to be that the bacilli passed through the intestinal mucous membrane without causing any obvious lesion and were arrested in the glands.[2] This interpretation seems to be accepted by most pathologists, and is certainly in harmony with the results of feeding experiments with animals. Most forms of primary abdominal tuberculosis, whether affecting the intestines, peritoneum, lymphatic glands, spleen or liver, are, therefore, in all probability due to infection through the intestine. More than this, many cases of neck and lung infection are due to bacilli taken with the food. Ravenel has recently said: "Dr. Pearson and I have held for a long time that *food tuberculosis may appear first in the lungs or cervical glands.* I have just received a letter from Dr. Pearson saying that he has killed two cows fed on tuberculous matter, and 'both had extensively tubercular lungs, and lesions nowhere else. The post-pharyngeal lymph glands were normal. Neither had the slightest disease along the digestive tract.' We have made similar observations repeatedly on dogs and pigs."[3] Observations of the same kind have been frequently made in the experiments of the Bureau of Animal Industry.

[1] Lancet, vol. 2, 1894, pages 957-960.
[2] The Journal of the American Medical Association, Aug. 31, 1901, page 590.
[3] Philadelphia Medical Journal, Aug. 24, 1901, page 284.

If, therefore, it is true and may be admitted that some cases of intestinal tuberculosis are caused by bacilli inhaled or which reach the saliva from the affected lung, it is also true that in an even larger number of cases the respiratory organs are infected by bacilli taken with the food. Certainly this is the case with animals, as shown by feeding experiments, and probably also with the human subject. The location of the lesions is, therefore, a very uncertain guide in many cases as to the manner in which the infection entered the body.

The new method of diagnosis which Koch desires us to accept, namely, the culture of the bacillus and the subcutaneous inoculation of cattle with the cultures, is yet of doubtful reliability. It has been assumed by Smith and Koch that the bacilli of bovine tuberculosis, if they produce disease in man, would retain their peculiar characteristics indefinitely, so that when isolated from the human lesions and inoculated in cattle they could be identified by their virulence for bovine animals. This is an assumption which has never been demonstrated. The method may or may not be correct, and it is only reasonable for us to decline to accept it for deciding so important a question until after its efficiency and reliability have been demonstrated. Koch says: "Hitherto nobody could decide with certainty in such a case whether the tuberculosis of the intestine was of human or of animal origin. Now we can diagnose them." It is only just to our own countryman to say that we could make the diagnosis as well after the publication of Theobald Smith's paper three years ago as we can after reading Koch's address. But the method is still in its infancy, and no one has cultivated germs known to be of bovine origin that have existed for some time in the human subject, to determine whether or not they retain their distinctive properties. Bacilli from different cases of human tuberculosis differ in virulence, and the extremes of pathogenic power in such bacilli have never yet been established. It is also true that bacilli from bovine sources differ in virulence, and here again the extremes of virulence have never been determined. Moreover, we do not know how much or how soon the bovine bacillus is modified when it propagates itself in human tissues. The experiments of Smith have opened up a wide field and lead to important suggestions, but we cannot yet say what conclusions will be reached by experimenting along the suggested lines.

It is to be observed that Koch does not positively answer the question as to the susceptibility of man to bovine tuberculosis, but acknowledges that it "will not admit of absolute decision to-day or to-morrow." He insists that "if such susceptiblity really exists, the infection of human beings is but a very rare occurrence," and estimates "the extent of the infection by the milk and flesh of tuberculous cattle, and the butter

made of their milk as hardly greater than that of hereditary transmission." This language shows his uncertainty on the great question which he has raised, and bearing upon which he has offered so little evidence. If the extent of the infection from bovine sources equals that by hereditary transmission, then the danger exists, it is a real danger, and we should strive to ascertain its exact extent and how much greater it may become.

To ask the medical profession at this time to adopt sweeping generalizations on inconclusive experiments and on mere hypotheses is absurd. To expect that the definite and positive evidence from accidental inoculations, clinical observations, vital statistics, and post-mortem records, will be discarded in order to adopt such hasty generalizations is ridiculous. More positive evidence will doubtless be forthcoming in the near future, as investigators will not rest until the most exhaustive researches have been made. In the end even this dramatic promulgation of a dangerous doctrine, practically unsupported by facts, will bring good to the cause of sanitation. What we must guard against is the influence of the sensationalists and of those very impressionable persons who are ever ready to accept a new doctrine which comes with the sanction of authority, no matter upon how slight a foundation of fact it rests.

In this case it is reassuring to find that the British Congress on Tuberculosis not only did not accept the doctrine, but declared that "medical officers of health should continue to use all the power at their disposal, and relax no effort to prevent the spread of tuberculosis by milk and meat." In this conclusion your committee most emphatically concurs.

SUMMARY OF A PAPER GIVING SOME FACTS WHICH TEND TO SHOW THAT BOVINE TUBERCULOSIS CAN BE THE SOURCE OF THE SAME DISEASE IN MAN.

By Dr. JÉSUS CHICO, Guanajuato, Mexico.

Since 1890 I had noted down some clinical records which, perhaps, will have a special value now that Koch's statements in the last congress on tuberculosis have called in question the identity of human and animal, especially bovine, tuberculosis. Not to make a long story out of a short one, I will simply state the facts as they came to my knowledge.

F. P., a powerful and healthy man, was the driver of the stage-coach which plied between Irapuato and Cuitzeo. Spending most of his life in open air during the best hours of the day for an outing, he had exceptionally strong lungs which were the better for the shouts with which, rather than with the whip, he used to urge on his team. His thoracic expansion, when measured by me in 1890, was fourteen centimeters (0.14) a limit seldom reached, and only once (in my personal experience) overreached by Mr. S., a merchant of New York. His wife, a well built and healthy matron, a fit mate to her husband, has also first rate lungs; but nevertheless, three of their children show different stages of pulmonary consumption, to which they have since then succumbed.

There was no uncle or aunt, no relation or friend of theirs, in more or less intimate connection, to account for the development of such a dreadful disease in that unhappy family; but Dr. Miguel Orozco, an able and well-known Irapuato physician, had several times warned them against having for food lungs with spots of whitish mass in several parts, but especially about the thinner portion or point, such as they used to buy of their butcher. Dr. Orozco had told them that such whitish mass showed tuberculosis of the cows; but, as the butcher had ridiculed that idea, they had believed his opinion the right one, because, being a butcher, he should know cattle diseases better than a man exclusively concerned with human ailments. They went on eating such lungs and at the end of five years three of them had more or less advanced forms of pulmonary tuberculosis.

The second of my records relates to a butcher, a fat and portly person. He was married and there had been only one offspring of his matrimony, a daughter on whom he and his wife doted. They were anxious to leave a competent income to this daughter and saved as

much as they could and, unfortunately, sometimes more than they should, for when people began to mistrust the portions of lungs, or other parts of the carcases, which had white caseous masses in them, they, that is the butcher and his wife, sold to their customers the unobjectionable portions and kept for their own cooking those which could possibly have been objected to. The whole family contracted tuberculosis, and in the space of four years, the daughter first, and then the father, and last of all the mother, died of the disease.

As in the former family, to which I referred, there was no other circumstance accountable for the development of the disease except tuberculized portions of the meat and lungs of animals which suffered from the disease.

And now let us come to the third group of cases; another family of four persons which disappeared in a short period and whose disease can only be traced to the use of tuberculized meat and bowels of diseased calves. But I shall not enlarge a great deal upon the antecedents of the case, I will only state that, without any apparent cause BUT THAT OF THE USE FOR FOOD OF ANIMALS AFFECTED BY TUBERCULOSIS, A WHOLE FAMILY OF FOUR PERSONS—FATHER, MOTHER AND TWO DAUGHTERS—DIED IN LESS THAN FIFTEEN MONTHS.

Not a single case of those spoken of was observed later than 1893. I did not believe them to be worthy of special mention because, not only I, but everybody else, then thought that the transmission of tuberculosis from animals to men was a fact not to be doubted. But now, that Koch in the last congress on tuberculosis held in London, (England), has cast the shadow of doubt on doctrines which, to a certain extent, were believed because of Koch himself, it is the evident duty of any one who may happen to know some facts which tell for or against that doctrine, to bring them forward to the notice of the public at large, not less than to the knowledge of the medical profession.

I am at present not less impressed with the significance of the facts related than I was at the time of the observation. They still seem to me a standing warning against the use of the meat and bowels of tuberculized animals. The words of Virchow uttered in Berlin, (Germany), two years ago when he told us that a tuberculized cow with her milk would be enough to destroy the whole population of a village, ring still in my ears, and at the same time Koch's words sound to me as something known long ago notwithstanding what the scientific world had believed in the possibility of transmission of the tuberculosis of animals to members of our own species. If you doubt that they are not new and ask me for chapter and verse to prove them to be old I cannot indeed give you neither the chapter nor the verse; but I can give you the book at least and that book is the Clinical Lessons of Dr. Jaccoud of Paris,

printed in 1884-1885, where there is to be read that many efforts to inoculate animals with human tuberculosis were unsuccessful, and that when those efforts had been of some avail the animals that had apparently become tuberculized were cured in a very short time, and only through the means of the *vis medicatrix naturae*, from what seemed to be an incurable tuberculosis.

How was it that the medical world did not heed then such experiments. No doubt because it only proved that the parasite of consumption had undergone some modification in the organism of man that weakened its strength against any other animal. Koch's words do not prove more than those experiments; we had taken every possible precaution against the spread of that disease through means of tuberculized meat or milk notwithstanding the knowledge of those facts. So, I believe, we must go on, whatever Koch might have said, taking for the welfare of our communities, any precautionary measures which till now has been recognized as necessary.

TUBERCULOSIS: HEREDITY.

By FELIX FORMENTO, A. M., M. D., New Orleans, La.

In medicine, more so perhaps than in any other science, a certain spirit of conservatism is required. Extreme ideas should be avoided. A middle course is the safest plan. A new discovery should not be too hastily accepted and should rest upon a solid and incontrovertible basis. It should not at once set aside all former knowledge founded upon the experience and observation of centuries.

Our new generation may be more learned and scientific than their predecessors, but does not possess, perhaps, to an equal degree, that spirit of observation which characterized them. *"Tota Medicina in Observatione,"* said Morgagni.

Now-a-days, there is perhaps too much laboratory work and not enough bed-side practical instruction. We turn out more savants than clinicians. The whole science of medicine seems reduced to bacteriology; the microbe has invaded every branch. We do not for a moment deny the importance of bacteriology and its glorious discoveries, but we fear that the study of man, in health or disease, is often sacrificed to that of the infinitesimal microbe.

All this is said in reference to the study of tuberculosis and the new medical ideas it has given rise to. The discovery of the bacillus tuberculosis is, no doubt, one of the great events of modern medicine. It has given a clear and precise idea of the disease and united into one classification many affections which were considered as being of a different character; it has made diagnosis perfectly certain; it has demonstrated that the disease is communicable from man to man and from animals to man; it has shown that the sputum of consumptives, loaded with tuberculous bacilli, is the great carrier of infection and that one of the first steps for the eradication of the disease is the destruction of said sputum and everything that may have been contaminated by its contact. So much to the credit of the tuberculous bacillus.

But are they not going too far and preaching an erroneous doctrine, those who affirm that tuberculosis is only transmitted by contagion and that heredity plays no part whatsoever in this transmission? Is it not time that we, sanitarians, should call a halt and enter our protest against the exaggeration of a doctrine which only takes in consideration one of the etiological factors of the disease, the bacillus, and neglects altogether the other factor, heredity or predisposition, or in other words, the soil necessary for the development of the germ? Yet, the observa-

tion of centuries has demonstrated that in tuberculosis, as in cancer and other affections, heredity is a powerful agent of transmission, and, to this day, taking into account our present knowledge of the bacillus, numerous instances could be cited showing the influence of heredity. Some cases of direct transmission of tuberculosis to the foetus in utero have been observed. Could there be anything more conclusive? Who has not known families in which tuberculosis was plainly hereditary for several generations? I could name several families, in my own practice, in which six and eight children, born from tuberculous parents, have died, at different ages and in different countries, of that terrible disease. Cases in which contagion could not well be invoked, for these families were intelligent, well educated and informed of that danger; they were living under the best circumstances, some having left the country of their birth to reside in Europe, in mountainous, healthy localities. Heredity, the fatal predisposition their parents had transmitted to them, followed them everywhere they went.

Dr. Fanning of Norwich recently declared at the London meeting that 52 per cent. of all cases treated in private sanatoria in England, descended from tuberculous parents (*Semaine Medicale, August 7, 1901*).

This proportion we believe to be still larger, as we know how difficult it is, at times, to find out the antecedents of a patient.

Without hereditary predisposition, local infection would remain sterile, at least in a great majority of cases. Tuberculosis, as frequent as it is, would be still more universal, without this individual predisposition; the air swarms with microbes; those predisposed alone succumb.

Whether heredity transmits directly the disease or furnishes a soil which renders the subject most liable to the least exposure, the result is the same. In both cases tuberculosis should be considered as hereditary.

Nor is this principle of predisposition peculiar to the subject now under discussion. We have numerous other analogous instances of the influence of predisposition. For instance, a foreign disease is introduced into a locality heretofore immune; if the locality is in perfect sanitary condition, the disease will not develop; if, on the other hand, its conditions are bad, the disease will rapidly spread. England, as an example, is opposed to quarantine measures, relying upon her excellent local sanitation, and believing that foreign pestilence would not find in her midst the conditions it requires for its development.

In order that a seed may properly develop, two conditions are required: an alive, active seed, and a proper soil. The same is true of a disease germ, whether the proper soil be found in the living organism or in the special conditions of a locality.

Predisposition is not always hereditary. It may be acquired. All debilitating causes, unhealthy trades and occupations, the want of pure air and sunlight, an insufficient alimentation, affect nutrition and predispose the strongest men, and children alike, to the ravages of tuberculosis. Low, damp, dark, badly ventilated houses render persons living in them more liable to contract the disease, by lowering the system, by diminishing its power of resistance; they are, at the same time, a most favorable *nidus* for the development of the bacillus.

The abuse of alcoholic drinks is a powerful predisposing cause to the disease.

In regard to tuberculosis, the sanitarian has a double duty to perform. He should always bear in mind the two great factors in the causation of the disease: individual predisposition, whether congenital or acquired, and the bacillus. We should make war upon the bacillus and try to exterminate it by all possible means, especially by the destruction of the sputum, the disinfection of rooms occupied by consumptives, and by the rigid inspection of milk and meat, in spite of the most recent claims of Koch. In this connection, it may be said that the theory advanced by Koch that bovine tuberculosis is different from human tuberculosis, so much so, that it cannot be transmitted from animal to man, has not been accepted by the scientific world. It is true that Koch pretends to have established, by direct experiment, that the human bacillus can not be transmitted to the cow, but has the reciprocal rule, which mainly concerns us, ever been established? Furthermore, are we to set aside as valueless, the remarkable experiments of Chauveau, who has succeeded in communicating tuberculosis to calves, by feeding them with tuberculous products of human origin and by injecting said products in the animals veins?

At the recent Congress of London positive and undeniable examples of transmission of tuberculosis to man by the use of milk from tuberculous cows were mentioned. Among them was the case of the daughter of Professor Gosse.

In the doubt, is it not safer to adhere to ideas generally accepted and to continue the rigid inspection of both milk and meat destined for human food?

International measures should be adopted, among civilized nations, for the disinfection of railroad trains, steamers, hotels, etc.

We should, at the same time, endeavor to render sterile the soil which the bacillus requires for its development. We should, by the strict enforcement of all known laws of public and private hygiene, try to modify and strengthen delicate constitutions, so as to enable them to better resist the attacks of the disease. Our effort should commence at the cradle, in fact, before birth, by abolishing the marriage of consump-

tives, by preventing tuberculous mothers to nurse their children, by furnishing the infant with pure, fresh milk, from a healthy woman in preference, etc. Our efforts should be carried on systematically through childhood and youth. Schools, colleges, manufactories, all places where congregate a large number of persons, tenement houses, etc., should claim our special attention. Our best endeavors should be more particularly pursued in those families, in which hereditary or acquired predisposition exists, rendering their offspring more liable to contract the disease. In order to carry out all necessary prophylactic measures, the first condition is a law or ordinance requiring that all cases of tuberculosis be reported to the proper authorities, a measure which I strongly advocated in a paper read at the conference of State and Provincial Boards of Health at Detroit, in 1898.

It is only by the persevering combination of all those means that we may expect to be successful in removing gradually from our midst this most cruel enemy of mankind. Our programme should be: the destruction of the bacillus, the hardening of the individual.

The general public, once informed by the newspapers, lectures, popular literature, etc., that tuberculosis can be avoided by hygienic measures, will became our most powerful auxiliary in our crusade against tuberculosis.

SUMMARY OF A PAPER ON SANATORIA FOR CONSUMPTIVES.

By DR. A. CARRIEDO, Oaxaca, Mexico.

It is a well-known fact that consumptives can only be cured with the aid of hygienial treatment, without which pharmaceutical means would be of little or no avail. The daily experience of physicians, everywhere, tends to confirm what I have said. Until bacteriologists provide us with something better than Koch's tuberculin, the medical sanatoria must fill the vacuum so sadly felt in therapeutics by the absence of any other efficient means.

Where are to be found the most proper places for such establishments? I do not doubt that among the best ones, the City of Oaxaca stands in the first rank. This town is situated in the valley, after which the city is named, "The Valley of Oaxaca." The fertility and picturesque beauty of this valley and at the same time its excellent climatic conditions, may be surmised from the following historical fact: Hernán Cortés, the conqueror of Mexico, from among the many delightful spots available, chose this one as his own, and so his title, after the conquest, was "Marquis of the Valley of Oaxaca." So clever a man, who owed his success to his astuteness, rather than to the prowess of his strong arms and valiant heart, took out of innumerable jewels of the land that valley, because it was the best of all.

Its altitude above sea-level is 1,500 meters (some 4,600 feet) out of the reach of yellow fever; and, as the latitude is only 17° north of the equator, the number of chilly nights—so common in the Mexican highlands, where a warm and sultry day is often followed by an extraordinary cool evening and a worse night—is considerably less than that of many other places which enjoy a better renown; a circumstance of paramount importance in the treatment of a disease in which, above all, chilly nights must be avoided. I am not prepared to give a minute meteorological study of the climate of the Valley of Oaxaca; but if I describe it as a perennial spring, these words, which in many many cases, are only a rhethorical figure of speech, must be taken in their most literal sense, if applied to that valley.

Of course, not every spot of that region is exactly like any other one: all are good; but the best is San Felipe del Agua, a suburban town of the City of Oaxaca itself, within easy reach of everything which would be wanted in any emergency. If you add to these important advantages a scenery which could not be easily surpassed by many of the most

picturesque Swiss landscapes, you would not be surprised by my saying that the average duration of life of consumptives sent to San Felipe del Agua is reckoned to be *five years* longer than the average of those who dwell in many other places of the valley, and that the percentage of complete *restitutiones ad integrum* (of course, before the ulceration of the affected portions has made considerable strides) is uncommonly high.

I speak as a practitioner; statistics with their tabular statements, can be made to say many favorable, but not always exact, things. I am much more impressed by the simple and honest statements of one of my fellow-practitioners, than by a tangle of figures of rainfall, barometrical pressure, hygroscopical observations and mean, maximum and minimum averages of morning, noon, evening and night temperatures, together with death-rate, data and so forth; and I take it for granted that all, or nearly all, practitioners are of my own way of thinking. If you wish to resort to a climatic cure in the first stages of consumption, send your patients to Oaxaca City, State of Oaxaca, Mexico. If you happen to know some millionaire, who may have the hobby of establishing sanatoria, as Mr. A. Carnegie has that of presenting libraries, tell him to begin by establishing one sanatorium at San Felipe del Agua, Oaxaca, Mexico. It will pay, and is only seven days in time from the American-Canadian border.

This is not a study; it is the friendly chat of one of the humblest medical members of the A. P. H. A.; but what he has had the honor to tell you, are true facts of his own personal observation. May you hear them with the indulgence and kindness which always keep company with knowledge.

REPORT OF COMMITTEE ON TEACHING OF HYGIENE AND GRANTING OF DIPLOMA OF DOCTOR OF PUBLIC HEALTH.

Your committee during the past year has studied the question of what may be considered the normal educational standards of hygiene, and wishes here to acknowledge the valuable assistance received from persons not on the committee, in this matter. It was considered that the subject should be classified under the following divisions:

1. Hygiene instruction in connection with medical schools and universities.

2. The higher hygiene instruction for diplomas or certificates of hygiene, such as is required by health officers, sanitary engineers, and other sanitary experts as chemists and bacteriologists.

3. Hygiene instruction to school teachers and school children.

4. Hygiene instruction in veterinary schools.

5. Hygiene instruction to the sanitary inspectors, inspectors of food, etc.

6. Regulations of hygiene instruction by boards of regents.

The reports received from different members of the committee have been submitted and are appended hereto, and the following is a summary of the conclusions arrived at, based upon these and upon correspondence arising from them:

HYGIENE INSTRUCTION IN MEDICAL SCHOOLS AND UNIVERSITIES.

The average medical student requires sufficient compulsory instruction to fit him for such hygienic work as arises directly out of his practice and which will enable him to coöperate intelligently with health boards. This calls for a general theoretical grounding in all branches of hygiene such as might be covered in a course of forty or fifty lectures and demonstrations, together with some elementary laboratory work in hygiene.

1. It would be advisable that some practical training in sanitation such as disinfection, house inspection, etc., be given either as an optional or compulsory course. 2. A more advanced optional course should be given, optional to students who wish to study the subject more deeply. 3. A diploma course, open to post-graduates, should be available for those who wish to become specialists in hygiene (see also under Section 2 of this report). 4. In addition to the above, a short series of elementary lectures on personal hygiene, forming a

course in sanitary science, and methods of prevention, such as come within the scope of the public, should be available for all students in the various faculties. 5. In connection with the course in sanitary engineering, architecture, etc., adequate arrangement should be made for instruction in hygiene and proper examination of the candidate.

DIPLOMAS IN PUBLIC HEALTH FOR MEDICAL HEALTH OFFICERS.

These require a special course and special examination. On the whole your committee considers that the English diploma of public health is one suitable for adoption as a standard. This requires six months' scientific training in hygiene, including laboratory instruction in sanitary chemistry, bacteriology and the study of preventable diseases, and six months practical training as assistant in the regular duties of medical health officer. Of these two courses only three months may be concurrent, and the candidate cannot pass any part of the examination until one full year has elapsed since his admission to the practice of medicine. The instruction in addition to the ordinary sanitary matters must comprise sanitary law, sanitary administration, and the study of hospital treatment of infectious diseases.

It will be noticed that the above qualifications are limited to medical men, and especially restricting the minimum requirements of the medical health officer. It is thus advisable that the sanitary bodies should make such arrangements as will enable persons holding these diplomas to have some advantage in securing or holding appointments. Possibly the holding of an appointment could be made conditional upon securing the diploma within a specified time.

It would seem advisable to have a somewhat higher qualification than the D. P. H., which might be obtained by further special study. This would correspond to the D. S. C. in hygiene, or to the doctor degree in hygiene, as given by the Scotch and some of the English universities. A course of this kind would call for at least two years post-graduate study, with special proficiency in some branch of laboratory work in addition to the general knowledge acquired by the D. P. H. and, at least for the doctor's degree, the presentation of a thesis representing original research.

Those parts of the course dealing with practical sanitation are, of course, not called for in the case of those holding appointments as medical health officers. Arrangements of the course should be such as to enable persons engaged in sanitary work to take them piecemeal who are unable to devote their entire time to the work.

It would seem advisable that similar provision be made for diplomas in veterinary hygiene and sanitary engineering, as far as possible, and the work of the laboratory experts in chemistry and bacteriology. In

the case of these special experts, however, it would seem more appropriate to require that the standard be particularly higher in the special branch in question than that the standard should be raised diffusely in all the branches of hygiene. The D. P. H. standard would seem to form a good groundwork from which specialization would be carried on in any branch.

A sanitary expert engineer should have same general knowledge of sanitary chemistry and bacteriology that would be required of the medical health officer, but would not require special instruction in preventive medicine and infectious disease. The sanitary chemist or bacteriologist would require at least two years' special training in his line of work with a certificate of a year's service as assistant in the special line of work and the passing of a special examination.

The examinations for the D. P. H., as specified, must cover at least four days and be written and practical, including both laboratory and outdoor sanitary work. The requirements of a sanitary analyst would be those in the main which are now required by the food and drug experts; it would be necessary that a knowledge of bacteriology as well as chemistry be required in each case. In several states these qualifications already exist. The highest standard is that of Austria and France, where four years special chemical training as students, and one year as assistant, is demanded before a certificate can be given. Part of this course is included in the ordinary college curriculum.

SCHOOL TEACHERS AND SCHOOL CHILDREN.

The qualifications established by the English school board for the teachers by which a certificate is conferred as a result of attending a course of about thirty or forty lectures on physiology and hygiene, especially adapted to their requirements, is one which seems fairly satisfactory. Your committee considers that such a course should either be made compulsory for all teachers or that special certificates be furnished those who take it. We cannot but strongly condemn the present prejudice which has led to the exaggerated exaltation of the study of the effects of alcohol and narcotics in this course, as displacing subjects which are of more importance. We consider that this topic in a forty lecture course could be dealt with amply in one or at most two of the lectures, and would strongly urge that the course in hygiene for school teachers should be directed rather to disseminating the knowledge of the laws of health than to the spread of temperance propaganda and statistics which can better be dealt with independently. A teacher who has obtained a certificate in the above mentioned course might be considered as competent to give elementary instruction in hygiene to school children where no better arrange-

ment can be made, and we think that hygiene and elementary physiology should be made part of the knowledge of every child. It is also recommended that a more advanced course in hygiene should be given to all students in universities and colleges, to include not only personal hygiene, but such instruction in Municipal, State and National Sanitation as would give them an intelligent and sympathetic interest in all measures relating to public health.

We would emphasize the view that the main object of instruction to teachers is to help them in carrying out intelligently such measures as may be necessary for the pupils under their charge, but that the supervision of the health of schools is much better entrusted to the school physician or medical school inspector who should be attached to all large schools. The qualifications for a medical school officer has not so far been formulated, but a special knowledge of school hygiene and the diagnosis of infectious diseases should be made one of the conditions for this position where the holder does not possess some other sanitary certificate covering the ground. We think it would be preferable, if feasible, that persons occupying positions of this kind have a D. P. H. certificate. The medical officer should be specially trained in making examinations as to the sight and physical condition of the pupils, and regulate such gymnastic exercises appropriate to their case.

THE REQUIREMENTS FOR VETERINARY SCHOOLS.

These should be analogous to those of medical schools, and in our opinion a diploma course in veterinary hygiene should be adopted. The special requirements indicated in Dr. Ravenel's report appear to be sound. The matter of regulation of veterinary instruction is one which is closely allied to that of the hygiene of domestic animals, and should be dealt with thoroughly in agricultural colleges.

EXAMINATIONS AND CERTIFICATES FOR SANITARY INSPECTORS AND INSPECTORS OF FOOD, ETC.

For this the requirements of the British Sanitary Institute appear to be specially well adapted and are quite feasible. These require a sufficient elementary knowledge of reading, writing, arithmetic, as well as general education, in order to allow the candidate to go up for the examinations. The course generally given covers from twenty to forty lectures with practical demonstrations, and the examinations are of a thoroughly practical character. The system followed in England of separating the inspector of nuisances from food inspectors is not called for on sanitary grounds, but is owing to the fact that these officials work under different departments and the requirements of each must be satisfied.

REGULATIONS OF HYGIENE BY BOARDS OF REGENTS.

Your committee would strongly urge that the health boards as far as possible insist upon only such men receiving the title of sanitary inspector as have earned it by passing the examination, to give the necessary encouragement to induce people to obtain these qualifications and by classing those who have not taken them as unskilled, making a distinction in their official titles.

Your committee would also suggest that such portions of this report as may be adopted by the Association should be submitted to those interested for their criticism and the effort made to secure their coöperation; and if a distinction is made between the minimum amount to be made compulsory everywhere and the normal standard which might be optional in some cases, we think that the matter can be practically tested without very serious delay.

We have appended to this report a short schedule showing the extent of the requirements in each of the above branches, as well as memoranda received from individual members of the committee.

(Signed) W. T. SEDGWICK, Chairman.
A. C. ABBOTT.
C. O. PROBST.
M. P. RAVENEL.
A. W. SUITER.
SEVERANCE BURRAGE.
WYATT JOHNSTON, Secretary.

INSTRUCTION IN HYGIENE FOR ARCHITECTS AND ENGINEERS.

By W. T. SEDGWICK, Massachusetts Institute of Technology, Boston.

It is in the training of engineers, architects and other technologists, it seems to me, the same problem that we have in the common schools, the colleges and the universities, namely, not whether we ought to have hygiene at all, but simply how much we ought to have. For my own part I firmly believe that no man or woman who has had any schooling at all, ought to have failed to receive, even in the lowest grades, some instruction in hygiene, as a guide to the feeling that the body is a reality, a mechanism, capable of wise use or unwise abuse, and as a help in the conservation and conduct of normal life and health.

At the Massachusetts Institute of Technology, those who propose to themselves to became architects, receive fifteen lectures (with demonstrations) on the principles of sanitary science and public hygiene. Attendance, only, is compulsary. No preparation is required, no examination or recitation. It is only attempted to state simply and in an interesting, but accurate way, the elementary facts and theories upon which the modern sanitary acts depend. These lectures are meant to give a point of view, a general, yet somewhat technical, knowledge which shall contribute to a sensible, intelligent approach to professional problems. The architect has no time, for example, to be a bacteriologist, but he does need to realize what bacteria are and how they may be disseminated in air and dust. Ventilation and heating, on the other hand, are problems with which he himself must often deal. In these subjects, therefore, more time, more work, more proficiency, are required.

The two great tests of the necessity and value of any subject in a scientific, technical professional school are (a) its power of contributing to general professional intelligence and (b) its efficiency as a practical tool. Tested by these standards, general hygiene ought to be of special value to sanitary engineers, chemists and architects, but of very little value to electrical engineers, railroad, bridge, mechanical, chemical or marine engineers; while technical laboratory instruction in hygiene, for those who mean to use it as a practical tool, must be given, in addition to general hygiene, to sanitary engineers, sanitary chemists, naval architects and sanitary biologists.

This plan is, in fact, pursued at the Massachusetts Institute of Technology. Those who need or desire chiefly an intelligent point of

view of hygiene in their professional work, can get it in the fifteen lectures (with demonstrations) mentioned above. Those, on the other hand, who require hygiene (or some branch of it) as a tool, receive in addition, special, detailed and practical laboratory instruction in heating and ventilation, general bacteriology, sanitary chemistry, sanitary biology, the microscopical analysis of water and sewage, microscopy, and the like, according to their needs. I may add that, it is by no means left to the students themselves to determine their own necessities, but rather to the mature judgment of the faculty, by whom the several courses of study have been framed, with care and deliberation.

It would take too much space, and it would be superfluous, to give in detail descriptions of the particular courses suitable for engineers and architects. The requirements for admission to the several courses should be simply so much of preliminary training and knowledge, as shall enable the student to follow them with ease and advantage. The examinations and certificates at the close should cover the ground actually cultivated, and be as telling as possible; and the length and character of the courses will necessarily vary widely according to local demands and facilities, so that no hard and fast rules, of general applicability, can be given. For the present at least and until the lower schools do better work in hygiene than they are doing to-day, any course in the higher and technical schools must work out its own salvation.

UNIVERSITY TEACHING IN HYGIENE.

By Dr. A. C. ABBOTT,

Professor of Hygiene and Bacteriology, University of Pennsylvania.

Something more than two years ago Dr. Charles Harrington of Harvard University, presented a report to the Committee on Medical Education, setting forth the status of the teaching of hygiene in the schools of this country at that time.

Of thirty-one schools purporting to teach the subject, according to that report, three only *required* hygiene and offered laboratory courses in connection with the didactic lectures; thirteen *required* the subject but had no facilities for practical laboratory work, and fifteen offered didactic instruction but required no examination upon the subject.

From this it is evident that in this country there is little or no concensus of opinion upon the importance of this subject to medical education.

In the schools of Great Britain the subject is required; in several universities laboratory work is compulsory, and in most of the more prominent schools degrees are offered to medical graduates who pursue for a period, after receiving their medical degree, a prescribed course of study, most of which is practical in nature.

In Germany candidates for license to practice must give evidence of having had both didactic and laboratory instruction in hygiene; in consequence there are laboratories for practical work on the subject at most of the German schools.

It is probable that the neglect of the subject in this country is referable to the lack of demand for trained men. It is too often true that preparation for his duties is among the minor qualifications required of the appointee to our public health offices. This, we believe, cannot continue indefinitely. The practical advances that have been made in preventive medicine, in hygiene, and in sanitary engineering, are daily becoming more appreciated by the community, and we believe the time not far distant when public opinion will demand of those responsible for the administration of public health duties, a practical familiarity with the functions that they are employed to perform. Whether this is or is not a gratuitous assumption, it is an opinion that should be encouraged and fostered, and the proper place at which to begin the agitation is the educational institution. With courses of study so arranged as to insure a broad comprehension of the manifold problems of public health our

universities will send into the community men whose influence can be but for good, even though at this time there may be but little opportunity for the utilization of this knowledge in a direct practical way.

University teaching in hygiene may be considered under two heads, namely, that leading to such official and formal recognition as a degree in course, and that providing for instruction in some one or another of the special phases of the subject but not leading to a degree.

With regard to the course leading to a degree it has for years been the practice in the universities of Great Britain to confer the degree of Doctor or of Bachelor, or to award diplomas in public health, state medicine or hygiene to candidates possessing the required qualifications.

The requisite preliminary education, courses of study, and details of curriculum vary to some extent in the different schools, but in certain particulars there is more or less of uniformity. In general it is required that the candidate before he is eligible for such a degree shall have been a registered graduate in medicine of a recognized school for a period of not less than twelve months; for a period (three to six months) he shall have received practical instruction in a hospital for contagious diseases; that he shall have had (usually six months) experience in outside practical sanitary work under a medical officer of health; that he shall have heard a course of lectures in public health in a recognized school; and that for a specified time (usually six months) he shall have worked in a recognized laboratory of hygiene upon the subjects of bacteriology, chemistry and physics in their bearings upon hygienic problems.

The minimum time required for this work is about two years, and the candidate is not permitted to present himself for his first examination earlier than twelve months from the time of his graduation in medicine.

The degree is conferred upon candidates who have successfully passed written, oral and practical examinations in the subjects required; these, as stated, vary in the different schools. Thus, for instance, in Edinburgh, he has a practical examination in public health laboratory work, in physics and in geology; and a written, oral and, so far as possible, practical examination in sanitation, sanitary law, vital statistics and medicine in its bearing upon public health. At that school the successful candidate receives for this work the degree Bachelor of Science in Public Health. After a period of five years after having received this degree he may, upon the presentation of a thesis embodying the results of original research, and upon passing an examination, the nature of which is determined by the Senatus Academicus, receive the degree of Doctor in Public Health.

At Durham the degree of Bachelor in Hygiene is conferred upon men passing successful examinations in the following subjects: Sani-

tary chemistry, physics, sanitary legislation, comparative pathology, vital statistics, nosology, meteorology, climatology and geographical distribution of disease, sanitary medicine and practical hygiene. In addition, he is expected to pass a practical examination upon cases at the hospital for infectious diseases or elsewhere; to draw up outlines for annual or other reports of the medical officer of health; to report upon the condition of some actual locality; to analyze liquids, gases and specimens of food; to describe the construction and use of meteorological instruments, hygienic apparatus and sanitary appliances; to examine with the microscope submitted specimens; to describe submitted specimens of diseased organisms and tissues (human and other); to show a practical acquaintance with the usual methods of bacteriological examination; and to inspect and describe carcases.

At the University of Cambridge, a diploma in public health is awarded to registered graduates in medicine who have pursued studies in the following subjects for the required time: The principles of chemistry, physics and bacteriology, especially in their application to the analysis of air and water; the laws of heat and principles of pneumatics, hydrostatics and hydraulics, with special reference to ventilation, water supply, drainage, construction of dwellings, disposal of sewage and refuse, and sanitary engineering in general; the laws relating to public health; sanitary statistics; the origin, propagation, pathology and prevention of epidemic and infectious diseases; the effects of over-crowding, vitiated air, impure water, and bad and insufficient food; unhealthy occupations and the diseases to which they give rise; water supply and drainage in reference to public health; nuisances that are injurious to health; geographical distribution of diseases; and the effects of soil, season and climate upon the incidence of disease.

From these citations it is evident that the subject of hygiene in university teaching is taken much more seriously in Great Britain than it is in this country, and that moreover the teaching is in the main adapted to the needs of the medical man. In fact, no person who is without the degree of D. P. H. (or its equivalent degree) can hold the position of medical officer of health.

That this plan meets with approval is evidenced by its continuation.

Your committee is of the opinion that the time has arrived for our American universities to consider this matter seriously. It offers the following recommendations in which it asks your concurrence:

(1) That general hygiene be a compulsory part of medical education and that all candidates for the degree of M. D. and for state license to practice medicine, be required to appear for examination upon the subject. It is advisable, in this connection, that the course be definitely arranged with the needs of the medical man in mind. It should com-

prehend the subjects of contagious diseases from the sanitary standpoint; of disinfection, isolation, quarantine and disposal of the dead. It should include instruction upon prophylaxis in general, especially of protective vaccination and the antitoxic state; and the subjects of air, water, soil and foods should be treated from the standpoints of public health. Where possible elective (compulsory would be better) laboratory courses on the physical, chemical and biological sides of these subjects should be offered.

(2) That universities possessing the necessary equipment should offer degrees in course to medical graduates who pursue a prescribed course of study in hygiene and its correlated branches. This course should cover not less than two years and should be in so far as possible practical in nature. It might properly include:

First Part:

Chemistry and Bacteriology in relation to problems of public health.

Physics—including the laws of heat, pneumatics, hydrostatics and hydraulics.

Biology—including elementary botany and invertebrate zoölogy.

Geology—configuration and structure of the soil with reference to moisture, heat, drainage, etc.

Second Part:

Lectures on general hygiene—including causation of disease; sketch of specific diseases from the standpoints of—cause, geographical and seasonal distribution, modes of dissemination and prevention. Harmful occupations; isolation and quarantine; disinfection, etc. Where possible these lectures should be accompanied by clinical instruction in a hospital for contagious diseases.

Laboratory work in Practical Hygiene—including meteorology; atmosphere—physical, chemical and biological aspects; ventilation and heating; sanitary analysis of water, milk, foods and soil; study of disinfectants. This course should be supplemented by excursions to water works, incinerating plants, sewage disposal plants, etc., in order that the practical application may be seen.

Sanitary Engineering Technical features of—water supplies; drainage; street cleaning; disposal of sewage, etc.

Sanitary Architecture—Technical details of ventilation of schools, work shops, dwellings, public buildings, etc.

Lectures and demonstrations on the diseases of animals transmissible to man, with instruction in the method of dairy and meat inspection.

Lectures on public health organizations; the laws of nuisances; the legal aspect of public health work.

(3) In addition to the instruction leading to a degree, special courses adapted to the needs of the engineer, the architect, the sanitary inspector —such for instance as courses in bacteriology and chemistry in connection with the problems of water supply and sewage disposal; courses illustrative of the physical, chemical and biological principles that are included in the sanitary construction of buildings; courses in which the points to be observed in meat and milk inspection and in the investigation of slaughter houses, dairies, etc., and courses designed to instruct in such statistical methods as are utilized in sanitary and public health work. For these courses certificates should be given only to those who have profited by the instruction as evidenced by examination.

In offering these recommendations your committee have entered into details only for purposes of illustration. They are of course subject to revision and amendment as may be deemed advisable.

INSTRUCTION IN HYGIENE FOR VETERINARY STUDENTS

By Dr. M. P. RAVENEL,

Bacteriologist State Live Stock Sanitary Board of Pennsylvania.

The course should cover two years. In schools which have a three-year course, the teaching of hygiene should come in the second and third years.

First year (second of college course.)

1. General hygiene of the domestic animals, including the principles of feeding, watering, stable construction, ventilation, light, heat, etc. Breeding.

2. Outlines of bacteriology, theoretical and practical, including the making of culture media, methods of making cultures and examination of same. Methods of examination of water, milk, air, etc.

3. Disinfection, disinfectants, apparatus for disinfection, etc.

Second year (senior.)

1. Advanced bacteriology, isolation of bacteria from animals where possible, and study of the known pathogenic varieties found in diseases peculiar to lower animals. Special attention should be given to those diseases common to man and animals, and those transmissible to man from animals.

2. Animal parasites transmissible to man, and methods of examination.

3. Quarantine in infectious diseases. Methods of controlling and suppressing outbreak. Disposal of bodies of dead animals.

The above course supposes the study of meat inspection and pathology in the school. Not less than eight weeks in each year should be devoted to the above course, four days per week.

TYPHOID FEVER DEATH RATES IN AMERICAN CITIES.

By GEORGE W. FULLER, Chairman, New York City.

PREFATORY NOTE.

The typhoid fever death rates contained in the following table were computed, with few exceptions, from data in the "Statistics of Cities," published each year in a bulletin of the U. S. Department of Labor.

The Committee on the Pollution of Public Water Supplies has separately collected many of these records, but it is deemed more judicious, for the sake of uniformity, to use the data published officially in accordance with an act of Congress.

It is to be noted that the official year of the Health Departments in some cities does not end at the same time that it does in others, but the rates given under each year are comparable in the case of each city.

The populations of all cities for the years 1898 and 1899 were estimated on the basis of a uniform rate of growth from 1890 to 1900. Using populations estimated in this manner, rates are obtained which in many instances differ somewhat from those computed from populations estimated prior to the census of 1900.

TYPHOID FEVER DEATH RATES PER 100,000 INHABITANTS IN CITIES OF THE UNITED STATES OF OVER 30,000 POPULATION.

City.	State.	Population in 1900.	Typhoid Fever Death Rate.			
			Average.	1898.	1899.	1900.
Akron	Ohio	42,728	29	18	32	36 (?)
Albany	N. Y.	94,151	79	99	87	51
Altoona	Pa	38,973	33	35	34	31
Allegheny	Pa	129,896	86	58	107	93
Allentown	Pa	35,416	49	57	64	25
Atlanta	Ga	89,872	55	15	88	61
Auburn	N. Y.	30,345	28	14	23	46
Augusta	Ga	39,441	34	21	46	35
Baltimore	Md	508,957	35	38	30	37
Bayonne	N. J.	32,722	21	43	4	15
Binghampton	N. Y.	39,647	51	72	28	53
Birmingham	Ala.	38,415	45	25	40	70
Boston	Mass.	560,892	30	34	30	25
Bridgeport	Conn.	70,996	14	10	12	21
Brockton	Mass.	40,063	24	8	18	45
Buffalo	N. Y.	352,387	27	29	26	27
Butte	Mont.	30,470	40	68	39	13
Cambridge	Mass.	91,886	18	16	22	16
Camden	N. J.	75,935	33	45	39	16

TYPHOID FEVER DEATH RATES—Continued.

City.	State.	Population in 1900.	Typhoid Fever Death Rate.			
			Average.	1898.	1899.	1900.
Canton	Ohio	30,667	40	57	40	23
Charleston	S. C.	55,807	122	131	109	127
Chattanooga	Tenn	30,154	67	72	65	63
Chelsea	Mass	34,072	24	21	30	20
Chester	Pa	33,988	64	49	108	35
Chicago	Ill	1,698 575	28	38	26	20
Cincinnati	Ohio	325,902	35	33	37	36
Cleveland	Ohio	381,768	40	34	32	54
Columbus	Ohio	125,560	31	28	23	42
Covington	Ky	42,938	39	29	40	49
Dallas	Texas	42,638	47	48	52	42
Davenport	Iowa	35,254	32	9	44	43
Dayton	Ohio	85,333	30	22	37	30
Denver	Colo	133,859	38	32	39	42
Des Moines	Iowa	62,139	21	38	15	10
Detroit	Mich	285,704	19	18	20	18
Dubuque	Iowa	36,297	23	23	17	28
Duluth	Minn	52,969	62	52	39	94
Elizabeth	N. J.	52,130	13	14	18	8
Elmira	N. Y.	35,672	43	49	31	48
Erie	Pa	52,733	28	14	35	34
Evansville	Ind	59,007	60	49	67	63
Fall River	Mass	104,863	15	21	11	14
Fitchburg	Mass	31,531	21	20	10	32
Fort Wayne	Ind	45,115	31	23	34	35
Galveston	Texas	37,789	67	42	87	71
Grand Rapids	Mich	87,565	36	34	31	42
Hartford	Conn	79,850	47	48	49	44
Harrisburg	Pa	50,167	41	33	41	48
Haverhill	Mass	37,175	18	23	14	16
Hoboken	N. J.	59,364	21	14	31	17
Holyoke	Mass	45,712	21	18	25	20
Houston	Texas	44,633	33	39	30	29
Indianapolis	Ind	169,164	38	30	39	44
Jersey City	N. J.	206,433	24	36	15	21
Johnstown	Pa	35,936	83	30	81	139
Kansas City	Mo	163,752	31	26	31	36
Kansas City	Kans	51,418	46	33	.	60
Knoxville	Tenn	32,637	88	179	41	43
Lancaster	Pa	41,459	59	66	69	41
Lawrence	Mass	62,559	25	19	33	22
Lincoln	Neb	40,169	18	17	22	15
Little Rock	Ark	38,307	58	70	57	47
Los Angeles	Cal	102,479	43	46	41	42
Louisville	Ky	204,731	60	60	61	58
Lowell	Mass	94,969	21	26	18	18
Lynn	Mass	68,513	20	23	19	19
Malden	Mass	33,664	16	16	12	21
Manchester	N. H.	56,987	19	26	22	10
Memphis	Tenn	102,320	33	24	40	35
McKeesport	Pa	34,227	53	48	43	67
Milwaukee	Wis	285,315	18	17	17	21
Minneapolis	Minn	202,718	39	44	36	38
Mobile	Ala	38,469	62	62	56	68
Montgomery	Ala	30,346	54	48	57	56
Nashville	Tenn	80,865	46	28	62	48
Newark	N. J.	246,070	22	18	28	20
Newton	Mass	33,587	20	24	10	27

TYPHOID FEVER DEATH RATES—Concluded.

City.	State.	Population in 1900.	Typhoid Fever Death Rate.			
			Average.	1898.	1899.	1900.
New Bedford...	Mass...	62,442	30	29	26	35
New Haven	Conn...	108,027	30	38	27	26
New Orleans ...	La	287,104	54	66	55	40
New York.....	N. Y....	3,437,202	19	20	16	21
Norfolk	Va	46,624	64	68	79	45
Oakland	Cal	66,960	23	14	37	19
Omaha.....	Neb....	102,555	28	35	27	23
Paterson.....	N. J....	105,171	35	35	48	23
Pawtucket	R. I....	39,231	23	22	26	20
Peoria	Ill.....	56,100	24	21	18	32
Philadelphia ...	Pa	1,293,697	54	51	75	35
Pittsburg	Pa	321,616	108	71	110	144
Portland.....	Me.....	50,145	46	76	31	32
Portland.....	Oreg ...	90,426	28	24	24	36
Providence.....	R. I....	175,597	24	23	25	23
Quincy.....	Ill.....	36,252	35	37	25	44
Reading	Pa	78,961	50	68	34	49
Richmond.....	Va	85,050	55	34	44	88
Rochester.....	N. Y ...	162,608	17	14	19	18
Rockford.....	Ill.....	31,051	5	3	10	3
St. Joseph.....	Mo.....	102,979	19	13	36	7
St. Louis.....	Mo.....	575,238	23	17	23	29
St. Paul.....	Minn ..	163,065	23	28	19	22
San Antonio....	Texas..	53,321	67	..	44	90
San Francisco..	Cal	342,782	37	17	52	41
Saginaw	Mich...	42,345	25	14	26	35
Salem.....	Mass...	35,956	23	29	20	19
Salt Lake City.	Utah...	53,531	30	44	21	26
Savannah.....	Ga	54,244	34	38	36	29
Schenectady ...	N. Y....	31,682	21	4	..	38
Scranton.....	Pa	102,026	23	14	25	29
Seattle.....	Wash...	80,671	32	33	33	30
Sioux City.. ..	Iowa ...	33,111	23	21	9	39
Somerville	Mass...	61,643	20	19	25	15
South Bend.....	Ind	35,999	35	27	..	44
Spokane.....	Wash...	36,848	57	57	48	65
Springfield.....	Ill.....	34,159	44	43	60	29
Springfield.....	Mass...	62,059	26	26	25	27
Springfield.....	Ohio ...	38,253	44	24	64	44
Superior..	Wis . ..	31,091	63	29	34	125
Syracuse.....	N. Y....	108,374	31	45	19	29
Tacoma.....	Wash...	37,714	25	40	13	21
Taunton.....	Mass...	31,036	25	27	23	26
Terre Haute....	Ind.....	36,673	57	42	58	71
Toledo.....	Ohio ...	131,822	32	25	31	39
Topeka.....	Kans...	33,608	43	30	75	24
Trenton.....	N. J....	73,307	36	31	46	31
Troy	N. Y....	60,651	101	73	76	155
Utica.....	N. Y....	56,383	22	22	18	25
Washington....	D. C....	278,718	68	64	62	77
Waterbury	Conn...	45,859	40	31	34	54
Wheeling	W. Va..	38,878	82	87	70	90
Wilkesbarre....	Pa	51,721	29	39	30	19
Wilmington....	Del	76.508	48	37	61	47
Worcester.....	Mass...	118,421	18	12	16	27
Yonkers.....	N. Y....	47,931	11	13	11	10
York	Pa	33,708	83	143	71	36
Youngstown....	Oh io	44,885	105	...	123	87

THE LEGAL ASPECTS OF WATER POLLUTION.

By J. L. LEAL, A. M., M. D., Paterson, New Jersey,

Member of Committee on Pollution of Public Water Supplies.

This is a subject which presents many difficulties to one not of legal training and profession, and I hope you will bear with me if I am forced to treat it rather from the standpoint of the layman than that of the lawyer. In undertaking the work it seemed to me to be incumbent, first, to obtain all statute law upon the subject; second, to compare these laws and to observe their growth and tendency from one period to another; third, to obtain the imporant judicial decisions upon the subject; fourth, to compare them and to observe the attitude of the courts in their application of the facts of modern sanitary science to the principles of the common law on the subject, which principles have been so long and firmly established.

In carrying out the work upon these lines I have communicated with the secretaries of the boards of health of fifty states and territories, or with their attorney-generals if no board of health existed. I received satisfactory replies from twenty-one states and territories. For these replies and the aid given I am indebted to Surgeon General Wyman, Drs. Egan of Illinois, Hurty of Indiana, Kennedy of Iowa, Baker of Michigan, Young of Maine, Fulton of Maryland, Lowber of Delaware, Lewis of North Carolina, Evans of South Carolina, Sanders of Alabama, Probst of Ohio, Wingate of Wisconsin, Bracken of Minnesota, Swan of Kansas, Tyler of Colorado, Mathews of California, Dr. Hope and Mr. E. W. Dobson of New Mexico, and to the Attorney-Generals of Georgia, Montana and Washington.

I am also under great obligations for assistance given to Vice-Chancellor Eugene Stevenson and Judge W. I. Lewis of New Jersey, and to the Bar Association of New York for the use of their library.

First. The statute law in the various states and territories. The only states and territories in which I can find no statute law upon the subject of water pollution are Louisiana, Arkansas, Texas, South Carolina, and Indian Territory. All other states and territories possess such laws, varying in their scope and utility from that of Georgia, which forbids in a few words the poisoning of wells, to the mass of legislation enacted in Massachusetts. I have here synopses of the statutes of these various states.

REFERENCES TO STATUTE LAWS OF VARIOUS STATES AND TERRITORIES.

ALABAMA—(Criminal Code, Sec. 5329, Sec. 5330, Sec. 5331).

ARIZONA—(Revised Statutes (1887), Sec. 572, Sec. 603).

ALASKA—(Annotated Code (Carter), p. 5, p. 33, p. 34).

CALIFORNIA—(Penal Code, Part 1, Title X, Sec. 374).

CONNECTICUT—(General Statutes (1888), Sec. 2651, Sec. 2652, Sec. 2653, Sec. 2654, Sec. 2655), (Laws of 1899, p. 1151), (Laws of 1901, p. 1378), (Laws of 1895).

COLORADO—(Mill's Annotated Statutes (Vol. 1, Sec. 1357), (Vol. 1, Sec. 1376), (Vol. 2, Sec. 3330), (Vol. 2, Sec. 4403)).

DISTRICT OF COLUMBIA—(Compiled Statutes (1889), p. 546).

DELAWARE—(Laws of Delaware, Vol. 12, Chap. 405, Secs. 1, 2, 3).

FLORIDA—(Revised Statutes (1891), Sec. 2658, Sec. 2665).

GEORGIA—(Georgia Laws (1896), No. 57).

INDIANA—(Laws of 1891. An act prohibiting the discharge of waste water and refuse of manufacturing establishments into streams of water, etc). (Thornton's Indiana Statutes, (Revised, 1897), 2180-157, 2181-158, 2182-159, 2195-168).

ILLINOIS—(Starr & Curtiss' Annotated Illinois Statutes (p. 785, No. 175), (p. 786, No. 176), (p. 1497, No. 20), (p. 1333, No. 369-2), (p. 133, No. 369-3),)

IDAHO—(Revised Statutes (1887), Sec. 6914, Sec. 6861).

IOWA—(Code of Iowa, (Sec. 5078), (Sec. 4979).)

KANSAS—(General Statutes (1897), Vol. 2, Chap. 100, Secs. 338-339), (Session Laws of 1889, Chap. 232).

KENTUCKY—(General Statutes (1894), Sec. 1278, Sec. 2057).

MASSACHUSETTS—(P. S., 1882, P. 1137), (P. S. 1882, P. 1176), (P. S. 1882, P. 448-449-450), (P. S., 1888, P. 169), (P. S., 1888, P. 676), (P. S., 1888, Chap. 375, p. 746), (Laws of 1897, Chap. 510).

MARYLAND—(Rev. Code, 1888, Art. 43), (Rev. Code, 1888, Art. 27), (Art. 27, Rev. Code Pub. General Laws of 1888). (Art. 27, Code of Pub. General Laws of 1888).

MISSOURI—(Revised Statutes (1899), Sec. 2234), (Laws, 1893, p. 147).

MONTANA—(Penal Code of Montana, Sec. 672, Sec. 676, Sec. 677).

MINNESOTA—(Laws of 1885, Chap. 225).

MISSISSIPPI—(Annotated Code (1892), Sec. 1326).

MAINE—(Laws of 1891, Chap. 82).

MICHIGAN—(Compiled Laws (1897), Secs. 4484-4485-4486, Sec. 11496, Sec. 2806, Sec. 3146, Sec. 11432), (Laws of 1899, Act No. 80).

NORTH CAROLINA—(Bulletin of N. C. Board of Health, May, 1899, Secs. 17-18-19-20, P. 137-8), (Laws of 1899, Chap. 670).

NEVADA—(Compiled Laws (1900), (Sec. 4708), (p. 348), (p. 24).)

NEW MEXICO—(Laws of 1899, Chap. 79), (Laws of 1897, Secs. 55-56).

NORTH DAKOTA—(Code of North Dakota (1899), (p. 1458), (Code of North Dakota (1899), p. 1529).

NEW HAMPSHIRE—(Revised Statutes (1901), Chap. 108, Sec. 13, Sec. 14, Sec. 17), (Acts of 1895, Chap. 76, Secs. 1, 2, 3, 4), (Acts of 1899, Chap. 57).

NEBRASKA—(Annotated Statutes (1895), p. 1348), (Annotated Statutes (1895), p. 1349), (Annotated Statutes (1895), p. 1350).

NEW JERSEY—(Laws of N. J., 1900, Chap. 72), (Act of March 14, 1893), (Act of March 29, 1878), (Act of March 24, 1897), (Act of March 17, 1899), (Act of April 17, 1884).

NEW YORK—(General Laws, (1900), p. 250, p. 2521, p. 2547, p. 2025).
OHIO—(O. L., Vol. 90, p. 94), (O. L., Vol. 90, Secs. 409-27 (3)) (O. L., Vol. 72, p. 112), (O. L., Vol. 93, p. 298), (O. L., Vol. 92, p. 287), (O. L., Vol. 70, p. 12).
OREGON—(Hill's Annotated Laws (1892), Sec. 1981, Sec. 1982).
OKLAHOMA—(General Statutes (1893), Sec. 2253, Sec. 2229).
PENNSYLVANIA—(Public Laws of 1895), (Public Laws of 1899).
RHODE ISLAND—(General Laws (1896), p. 977, Sec. 16).
SOUTH DAKOTA—(Annotated Statutes (1899), p. 922), (Annotated Statutes (1899), p. 923), (Annotated Statutes (1899), p. 924).
TENNESSEE—(Laws of 1826, Chap. 37, Sec. 1), (Annotated Code (1896), Sec. 6869), (Laws of 1866-7, Chap. 1, Sec. 1).
UTAH—(Laws of 1899, Chap. 45), Revised Statutes (1898), Chap. 35), (Revised Statutes (1898), Sec. 4279).
VIRGINIA—(Acts of 1874-5, p. 21), (Acts of 1891-2, p. 759), (Acts of 1887-8, p. 83).
VERMONT—(Vermont Statutes, Sec. 4589, Sec. 4892, Sec. 4695).
WASHINGTON—(Ballinger's Code, Vol. 1, Sec. 3085).
WEST VIRGINIA—(Acts of 1872-3, Chap. 176), (Acts of 1887, Chap. 25).
WYOMING—(Revised Statutes (1899), Sec. 5114, Sec. 5116).
WISCONSIN—(Annotated Statutes (Sanborn & Berryman, 1898), p. 651, p. 2763, Sec. 1418).

Second. Comparison of these laws and observations on their growth and tendency from one period to another.

The various states and territories I have divided into five classes according to the nature of their statute law upon this subject. This classification shows not only the tenor of, and the chief object sought by the statute law of each class, but also presents an orderly sequence in the developement of the whole matter of the legal prevention of water pollution from the point of time. This same sequence may be very plainly traced in the legislation of many of the individual states as well. Class 1, therefore, will represent not only the crudest but also the earliest attempts to prevent the pollution of water, while Class 5, will represent the latest and most approved efforts towards the same end. Many of the states have laws which would naturally bring them under more than one of these classes, a few indeed under all or nearly all of them, but in the case of each individual state I have depended in its grouping upon what I conceived to be the prevading spirit of its legislation.

First Class.

To this class belong those states the statute law of which goes no further than to forbid the "poisoning" of wells, springs and reservoirs. When these laws were passed it was for the purpose of preventing, or providing punishment for the wilful placing in drinking water of chemical poisons with intent to cause death or injury to others, but undoubtedly these laws would apply now to some forms of water pollution as we

understand it. It is therefore for this reason that I include these states among those having statute law against water pollution. To this class belong Georgia and Rhode Island.

Second Class.

To this class belong those states and territories the laws of which seek to prevent the pollution of water by reason of certain specific agencies of pollution, or, in other words forbids the pollution of water in certain ways. This was the next step in the evolution of the subject and was an attempt to legislate against the forms of pollution common at the time and known to injuriously affect the water, but especially rendering it less acceptable to the sight, the tast, the smell. To this class belong Vermont, Wisconsin, California, Idaho, Oklahoma and Indiana.

Third Class.

To this class belong those states and territories the chief aim of whose legislation seems to be the protection of a certain water supply or supplies. The explanation of this third step is that the people of some city or cities, either on account of some condition or conditions peculiar to their water supply, or more probably yet on account of a higher average of intelligence and knowledge than that of the state at large, and therefore the better able to appreciate its necessity, have sought and obtained for themselves a protection which others had not as yet appreciated the necessity of. To this class belong Michigan and the District of Columbia.

Fourth Class.

To this class belong the states and territories whose statute laws forbid the pollution of all waters used for public supply. It represents an advance in intelligence over the preceding class in that it shows the people of a whole state able to appreciate what only the people of a town could appreicate as therein shown. The various laws differ widely in the different states but their prevading spirit is the protection of water used for potable purposes. Many of these laws show plainly the changes in scientific opinion within comparatively few years. Some of the first of them forbid pollution of potable waters, but make an exception in the case of the discharge into them of the sewage of cities and towns, and the waste matters of certain industries. Then a little later will appear a law in the same or some other state forbidding such discharge within three or more miles of the intake of a water supply. Then finally is evolved the law forbidding all pollution of all water used for potable purposes. To this class belong Maine, Kansas, Delaware, Montana, Minnesota, Alabama, New York, Connecticut, Arizona, Vir-

ginia, Florida, Wyoming, New Hampshire, Alaska, Oregon, Mississippi, Pennsylvania. The states of this class possessing the most complete and effective legislation I should consider to be Connecticut, Minnesota, New York, Maine and Virginia.

Fifth Class.

Finally, to the last and most advanced class belong those states and territories which have sought by law to protect all waters within their boundaries. These laws differ widely in the different states as to their effectiveness and thoroughness, but in all an honest attempt is made to improve upon the conditions formerly prevailing as to our inland waters. In many of them it has been necessary to exempt from the provisions of the law certain waters practically used as a means of sewage disposal by cities and towns too ignorant, or too selfish, to be willing to allow their opportunities for the commission of such hygienic sin to be curtailed, or in connection with which certain influential interests were involved. The tendency is for these exceptions to grow fewer, however, and it seems reasonable to expect from the present outlook that it is only a question of a short time when the pollution of all inland waters must cease. The states and territories belonging to this class are Missouri, Tennessee, North Dakota, Nebraska, Kentucky, West Virginia, Utah, Nevada, Massachusetts, Iowa, Illinois, Colorado, New Mexico, Washington, Maryland, North Carolina, Ohio, South Dakota, New Jersey.

Those possessing the most advanced legislation I should consider to be Massachusetts, North Carolina, Utah and New Jersey.

Third. Judicial decisions upon the subject of water pollution.

I have here synopses of all the important judicial decisions upon this subject I have been able to find. I believe all important decisions are included. They are as follows:

JUDICIAL DECISIONS.

References.

Morgan v. City of Danbury. Supreme Court of Errors of Connecticut, April 15, 1896.

Fisk v. City of Hartford. Supreme Court of Errors of Connecticut, July 13, 1897.

Nolan v. City of New Britain. Supreme Court of Errors of Connecticut, November 3, 1897.

Platt v. City of Waterbury. Supreme Court of Errors of Connecticut, January 4, 1900.

Cleveland v. Beaumont. Ohio, 4 Bull, 345; 2 Clev. Rep. 172.

Robb v. Village of Lagrange. 158-21 (1895) Starr & Curtiss' Annotated Illinois Statutes.

Inman v. Tripp. 11 R. I., 520.

Morse v. City of Worcester. 139 Mass., 389.

Rivas v. City of San Antonio (Texas), S. W. R. 885.

City of Valpariso v. Moffitt. Appellate Court of Indiana, No. 1, 537.

Muncie Pulp Co. v. Martin. Appellate Court of Indiana, (No. 2, 957. Filed December 21, 1899.)

City of Richmond v. Test. Appellate Court of Indiana, (2,271. Filed November 24, 1897.)

Peck v. City of Michigan City. Supreme Court of Indiana, (Mo. 18, 186. Filed March 9, 1898.)

New York Central R. R. Co. v. City of Rochester. (127 N. Y., 591.)

Seifort v. City of Brooklyn. 101 N. Y., 136.

Mann v. Willey. (New York Supreme Court, Appellate Division, Third Department, May 2, 1900.)

Owens v. City of Lancaster. Supreme Court of Pennsylvania, July 15, 1897, and November 6, 1899.

Commonwealth v. Yost. (Supreme Court of Pennsylvania, July 11, 1900.)

Winchell v. City of Waukesha, Wisconsin, (85 N. W. R. 668).

Middlestadt v. Waupaca S. & P. Co. (93 Wis., 1.)

Green v. Nunnemacher. (36 Wis., 50.)

Woodyear v. Schaefer. (Maryland Court of Appeals, April Term, 1881.)

Ferguson v. Fermenich Co. (77 Iowa, 576.)

Indianapolis Water Co. v. American Straw Board Co. (53 Fed. Rep., 970.)

State of Iowa v. Smith. (82 Iowa, 423.)

Indianapolis Water Co. v. American Straw Board Co. Second Trial. (57 Fed. Rep., 1000.)

Trust Co. v. Prison Commission of Georgia. (92 Fed. Rep., 801.)

Herr v. Asylum, Kentucky. (30 S. W. 971.)

Kinnaird v. Oil Co., Kentucky, (12 S. W. 938).

Barrett v. Association. (Illinois Sup.) 42 N. E. 891.

Dwight v. Hayes. (Illinois Sup.) 37 N. E. 218.

Grey, Attorney-General, et al., v. City of Paterson. (N. J. Equity Rep. 58-1.)

Grey, Attorney-General, et al., v. City of Paterson, New Jersey. (45 Atl. Rep. 995.)

Fourth. A comparison of these decisions and what appears to be the present attitude of the courts upon the subject.

With but three exceptions all these decisions seem to agree upon vital points. These exceptions are the cases of City of Richmond v. Test et al., Appellate Court of Indiana; Commonwealth v. Yost, Supreme Court of Pennsylvania, and Attorney-General et al. v. City of Paterson, Court of Errors and Appeals, New Jersey. The Indiana case is entirely out of touch with the spirit of the majority of the decisions and with modern educated opinion. It might have been abreast with the times and public knowledge of fifty years ago in England and twenty-five years ago in the United States, but at the present time it is just so many years behind. The principle laid down is as follows: A municipal corporation which has constructed a system of sewers upon the best modern plan for conducting and discharging sewage and drainage, and has discharged the same into a natural water course, which is the natural drainage of the land upon which the city is situated, and has made the sewers conform

to the natural drainage, and constructed them substantially upon the lines of natural drainage and water courses which had previously carried the surface drainage, is not liable in damages to a lower riparian owner by reason of polluting the water with such sewage.

The other two cases differ from the majority technically rather than in spirit. In the Pennsylvania case the court held that the evidence did not show the maintainance of a public nuisance, but only a private wrong, and that therefore the form of proceedings was improper. In the New Jersey case the Court of Errors and Appeals in overruling an injunction granted by the Court of Chancery against the City of Paterson, forbidding it to continue to empty sewage into the Passaic river, bases its action upon the following grounds:

1st. The city of Paterson had legislative authority to construct its system of sewers, discharging their contents into the Passaic river, and is not, therefore, subject to the charge of maintaining a public nuisance.

2d. The title of riparian owners along the Passaic river, where the tide ebbs and flows, extends only to high water mark. The State is the absolute owner of the bed of the stream. Such riparian owners, having no title to the bed of the stream, are not entitled to an injunction against the city on account of the pollution of the stream.

3d. The title of riparian owners above the ebb and flow of the tide extends to the middle of the stream, subject only to a servitude to the public for purposes of navigation. The pollution of the river by sewage constituted the taking of the property of such owners, which the Legislature cannot authorize except upon just compensation.

4th. By reason of the great injury which would fall upon the city by restraining the continuous use of its sewerage system, and the acquiescence of these riparian owners above where the tide flows, their injury being comparatively small, it would be inequitable to grant them an injunction.

5th. They may obtain redress by amending their bill, or by filing a new bill praying for an injunction, unless the city of Paterson will consent to make such compensation to them as shall be ascertained to be just, or they may, if they so elect, sue at law for their damages.

The principles which the majority of the decisions seem to establish are as follows:

1st. A municipality may not empty its sewers upon private property without acquiring the right so to do. N. Y. Central R. R. v. City of Rochester, 127 N. Y., 591.

2d. A municipal corporation has no right, in the exercise of its power, to determine when, where, and how to make improvements, to do so upon a plan which substantially involves the appropriation by it of

the property of a citizen to a public use, without making compensation therefor. 101 N. Y., 136.

Where the act is of such a nature as to constitute a positive invasion of the individual rights guaranteed by the constitution, legislative sanction is insufficient as a protection. 101 N. Y., 136.

3d. A riparian owner has a right to the water in its natural purity, irrespective of the question of user. Mann v. Willey, May 2, 1900, N. Y.

4th. Where a city uses a stream as an open sewer, it cannot acquire by prescription a right to neglect its duty to keep open the channel and to remove the accumulation of refuse therein, and therefore we apprehend that the same principle would apply to the injury inflicted by allowing offensive and injurious odors and smells to issue from the polluting substances discharged into the stream from the city sewers. Owens v. Lancaster, Penn., 1897.

5th. If water coming to plaintiff's premises is impaired in value for the ordinary uses of life, or for special lawful uses by reason of any foreign substance imparted thereto by another from artificial causes, there is a nuisance, and when said nuisance is once established, the right of recovery cannot be defeated otherwise than by the establishing of a right by grant, or prescription, or by express license from the plaintiff. The usefulness of the works, their absolute necessity, nor the fact that they cannot be carried on without producing the result in question, nor the fact that the highest degree of care and skill is exercised to prevent injury, will be no excuse. Muncie Pulp Co. v. Martin, Indiana, No. 2-957.

6th. When, if ever, the Legislature shall enact that streams generally, or any streams, shall be used as sewers without liability to owners of soil through which they run, the question of constitutional protection to private rights may be forced upon the courts for decision. Until such enactment is made, however, in clear and unambiguous terms, we shall be slow to hold by inference or implication that it has been made at all. The authority granted to municipalities is to construct sewers, but subject to the general legal restrictions resting upon such corporations forbidding the invasion of private rights by creation of nuisance or otherwise. Wisconsin, Winchell v. Waukesha, 85 N. W. R., 668.

7th. When the Legislature authorizes a city or town to construct sewers, or to use a natural stream as a sewer, it is not to be assumed that it intends to authorize the city or town so to construct its sewers, or to so use the stream, as to create a nuisance. 139 Mass., 389.

8th. The doctrine that a municipality cannot be held liable for the consequences of an act which it is legally authorized or is required to

perform, will not justify an invasion of private property, even if the invasion is only consequential. R. I., 11-520.

9th. A village or city cannot, by virtue of its right to drain surface water over lower lands, run its sewage beyond the corporate limits upon premises of an individual owner, where such sewage is offensive and detrimental to health. Annotated Statutes, Illinois, 158-21.

10th. There can be no prescription for a public nuisance. The right of a riparian owner to have the water of a stream come to him in the natural purity, or in the condition in which he has been in the habit of using it for purposes of his domestic use or of his business, is as well recognized as his right to have it flow to his land in its usual quantity. Maryland, 1881, Woodyear v. Schaefer.

11th. The pollution of a stream through use of same by a city for sewerage purposes without a legal right so to do, rendering water unfit for domestic purposes and the watering of cattle, and causing the emission of noxious odors, is a public nuisance. Nolan v. New Britain, Conn., 1897.

12th. A city's discharge of sewage into a stream in such quantities as to destroy the value of property of lower riparian owners and to be destructive of health, is an unreasonable use of such stream. The right to maintain a nuisance by polluting a river, rendering it dangerous to the public health, and destructive to the value of neighboring property, cannot be acquired by prescription. Merely granting a city authority by its charter to construct sewers to carry off the refuse of its inhabitants to a river does not make such use of said sewers a governmental act, freeing the city from personal liability for injuries resulting therefrom, as from a lawful exercise of a governmental power.

Pollution of a river by city sewers so as to destroy the value of property located thereon is a taking of private property for a public use, within the meaning of the constitutional requirement that just compensation shall be paid therefor; and no matter what the necessity therefor, the city cannot avoid its liability to render just compensation therefor.

A city's prescriptive right to pour its surface drainage into a river does not include the right to mix therewith noxious substances which the river cannot dilute or safely carry off without injuring private property. Platt v. Waterbury, Conn., 1900.

13th. It is objected also that the city has right to empty its sewers into river whatever the consequences. This contention is based upon claim that it is a natural and reasonable use of the river, and that such right had been given by Legislature in authorizing city to construct its sewerage system. The sewage in question, it is remembered, is discharged into a stream above tide and where the stream is not navi-

gable. It does not naturally flow to the stream. It is gathered by the city in sewers from numerous buildings, cesspools, culverts and drains, over a large area of land, and by uniform artifically constructed grades is gravitated to and discharged into river. It is vastly more than the mere natural drainage of riparian owners. I cannot conceive of any tenable ground upon which such drainage can be classed as either a natural or a reasonable use of the river. It is not to be assumed that the statutes authorizing city to construct sewers mean to authorize a nuisance. The authority conferred is limited to mere construction of the sewers in accordance with the maps. It does not license either public or private nuisances through pollution of the waters of the river. As to private rights, I need only say that they have constitutional protection against any such legislative enactment. In England where the power of Parliament is omnipotent in matters of this kind, both as to public and private rights, it is well settled that legislative authority to merely drain into a stream does not authorize the contamination of the water. Legislative license to create a public nuisance of the kind considered must be given in express terms or by absolutely necessary implication. That the city has any right to pollute the waters of the river by the discharge of its sewage into them, is clearly an untenable proposition. Chancellor's opinion, Simmons et al. v. City of Paterson, N. J.

From the above the attitude of the courts at the present toward the pollution of water clearly appears. This attitude, which is of comparatively recent origin, seems not so much a stricter enforcement of the principles of common law, as a better understanding on the part of the courts of the principles of sanitary science. The common law always existed and was always enforced according to the lights of the courts, but the trouble was that those lights were not bright enough to illumine the subject. The brighter rays of modern scientific sanitation, however, have dispelled the gloom of ignorance and have pictured the subject in its true aspect, its importance and its necessities to the minds of those whose province it is to place it upon its proper legal footing. That this is one of the most important results obtained by sanitary science cannot be disputed.

THE PREVENTION OF YELLOW FEVER.[1]

By WALTER REED, M. D., Surgeon, U. S. A., and JAMES CARROLL, M. D., Contract Surgeon, U. S. A.

The prevention of yellow fever since its first importation into the United States in 1693, and especially during the latter half of the past century, has commanded, perhaps, more attention on the part of those who were concerned with matters pertaining to the public health, than the prevention of any of the other acute infections. This has not been occasioned by the fact that its total sickness and mortality have exceeded that of other acute infectious diseases, such as typhoid fever or croupous pneumonia, but because rather of the lack of knowledge of its specific agent; the consequent mystery surrounding its origin and propagation; the proximity of its source to our shores; the alarmingly rapid spread and course of this disease, when once it had obtained a foothold; and the high mortality with which its epidemics have generally been attended. Although the duration of its presence in our seaports was plainly limited by certain seasonal conditions, yet during its brief reign—July to October—its ravages were such as to completely paralyze both the social and commercial interests of a given city, and even of an entire section of our country.

The interval between 1793 and 1888 is almost one hundred years, but upon the appearance of yellow fever, we observe no difference of behavior on the part of the inhabitants of Jackson, Miss., in 1888, from that shown by the citizens of Philadelphia in 1793, except that the terror of the former was greater and their flight from their homes more precipitate than in the case of the latter. The recurrence of succeeding epidemics has, therefore, served to increase rather than to lessen the public alarm.

It would be difficult to determine with accuracy the loss of life occasioned by the ninety-five invasions of our territory by yellow fever during the past two hundred and eight years. We have endeavored to collect from the most available sources, the mortality caused by this disease, but have been unable to obtain any reliable data for the earlier epidemics. If we confine ourselves to the epidemics which have occurred since 1793, we find that there have not been less than 100,000 deaths from this cause. The greatest sufferer has been the city of New Orleans, with 41,348 deaths, followed by the city of Philadelphia

[1] The Association is under obligations to the Medical Record for the use of the cuts illustrating this paper

with 10,038 deaths. The epidemics of 1855, 1873, 1878 and 1879, claimed 7,759 victims in the city of Memphis, Tenn. From 1800 to 1876 Charleston lost 4,565 of its citizens by attacks of yellow fever. New York, during the earlier and later invasions of this disease, has had 3,454 deaths, while the epidemic of 1855 in Norfolk, Virginia, caused over 2,000 deaths. During our brief occupation of the island of Cuba, (July, 1898,—December, 1900,) with every precaution brought into exercise to ward off the disease, there have occurred amongst the officers and men of our army, 1,575 cases of yellow fever, with 231 deaths.

If we reckon the average mortality at 20 per cent., there have not been less than 500,000 cases of yellow fever in the United States during the period from 1793-1900.

Turning for a moment to other countries, we find that the great epidemic of 1800, in the province of Andalusia, Spain, caused 60,000 deaths, and that 20,000 more deaths attended the invasion of the city of Barcelona by this disease in 1821. From 1851 to 1883, the deaths from this cause in the city of Rio Janeiro were 23,338, while in the city of Havana, between the years 1853 and 1900, 35,952 deaths have been recorded from yellow fever.

We have no means of computing the damage done to the commercial interests of the United States by epidemics of yellow fever. At the Sixth Annual Meeting of this Association, held in Richmond, Virginia, in 1878, Dr. Samuel Choppin, President of the State Board of Health of Louisiana, estimated the actual cost of the epidemic of that year to the material resources of the city of New Orleans as $10,752,-500.00. Dr. Benjamin Lee, the present distinguished occupant of the presidential chair, at the Seventeenth Annual Meeting of this Association, held in Brooklyn, New York, in 1889, contributed a paper having the title: "Do the Sanitary Interests of the United States Demand the Annexation of Cuba?" From this we quote the following sentence: "A single widespread epidemic of yellow fever would cost the United States more in money, to say nothing of the grief and misery which it would entail, than the purchase money of Cuba." That this was no exaggeration witness the language of the petition which the chairman of the committee on the etiology of yellow fever, in conjunction with other prominent members of this Association, presented to the president of the United States, on November 15, 1897, and again, on November 21, 1898, in accordance with a resolution adopted at the meeting of this Association, held at Ottawa, Canada, in 1897. In addressing President McKinley, Dr. Horlbeck said: "It is hardly necessary to call your attention to the serious results of the recent epidemic of yellow fever in the states of Louisiana, Mississippi and

Alabama, but we may be permitted to mention the fact that the great epidemic of 1878 resulted in the loss of nearly 16,000 lives, and that it has been estimated that the total loss to the country resulting from this epidemic was not less than $100,000,000,00."

The importance of the study of the causative factors entering into the propagation of a disease so capable of quickly destroying the lives of its citizens and wrecking the commercial interests of the cities of the United States could hardly be over-estimated. Did time permit, we would be glad to refer to the numerous and valuable contributions made to this subject by the members of the American Public Health Association. We can only mention the establishment of the National Board of Health, and the appointment of the Havana Yellow Fever Commission of 1879 as two of the most important outcomes of the persistent efforts of this Association, following "the deeply tragical events of the summer of 1878." The exhaustive reports made by Chaillé in 1880 and by Sternberg in 1890 must always stand as monuments to the earnest spirit of investigation with which the work was pursued.

Notwithstanding the importance of the work and the efforts put forth by students in this and other countries, we believe that we are safe in saying that no results had been obtained which would enable us to successfully combat this disease when once imported into our larger centers of population, and no means found to keep it out of our ports except such as would place very heavy burdens upon commerce. This inability to control the disease grew not only out of our ignorance as to the way or ways in which yellow fever was propagated, but also out of certain false opinions which we had formed as to the mode of its spread. The doctrine of the spread of yellow fever by fomites and by filth had taken such hold on the professional mind as to completely overshadow all other views, and to direct into false channels the work of those who were engaged in the investigation of this disease. The efforts to isolate or to discover the specific agent of yellow fever, if successful, would possibly have greatly simplified the problem. In the absence of such discovery, the first step in our knowledge of how to prevent this disease could only be found, we think, along another line, viz., that of its propagation from the sick to the well. This step we endeavored to take, in connection with our colleagues, Dr. Agramonte and the late Dr. J. W. Lazear, of the United States Army, during our recent investigations into the causation and spread of yellow fever at Quemados, Cuba.

The results of our earlier work relative to the etiology and propagation of this disease we had the pleasure of presenting to this Association at its last meeting, held in Indianapolis, Indiana. You will re-

call that one of the conclusions which we then submitted was as follows: "The mosquito serves as the intermediate host for the parasite of yellow fever."[1] In the same article we briefly indicated the reasons which influenced us in pursuing this line of investigation, and it is, therefore, unnecessary to here repeat them.

Continuing our studies, especially as regards the means by which yellow fever is spread from individual to individual, and as to the manner in which houses become infected, we were able, under strict rules of isolation and quarantine, to bring about an attack of yellow fever in ten non-immune individuals (and always within the period of incubation of this disease) out of a total of thirteen (76.84%) whom we attempted to infect by means of the bites of mosquitoes—*Stegomyia Fasciata*—that had previously been fed with the blood of yellow fever patients during the first, second and third days of their attacks. These results were reported in part to the Pan-American Congress held in Havana during February of this year[2] and in part to the Association of American Physicians[3] at its last meeting held in the city of Washington.

It will be seen that we were able to establish in the most conclusive manner that the mosquito serves as the intermediate host for the parasite of yellow fever. At this same Experimental Sanitary Station we were also able to demonstrate that an attack of yellow fever cannot be induced by the most intimate and prolonged contact with the clothing and bedding of yellow fever patients, even though these articles had been previously thoroughly soiled with the excreta of such patients.

In other words. we were able to prove that the garments worn, and the bedding used, by yellow fever patients were no more concerned in propagating this disease, than the clothing and bedding of patients suffering from malarial fever are concerned in the spread of the latter malady. The doctrine of the spread of yellow fever by fomites having, at the first touch of actual experiment on human beings, burst like a bubble, we may hereafter cast it aside, with other exploded beliefs, to the very great simplification of the problem how to prevent yellow fever. Indeed, in our opinion, the time has now arrived when the latter problem may be reduced to measures which shall prevent the propagation of this disease by mosquitoes. Although the specific agent of yellow fever has not, as yet, been discovered, this must remain largely a matter of scientific interest, and does not, in the least, lessen the efforts which we, as sanitarians, are now able for the first time, to

1 Etiology of Yellow Fever—A preliminary note, Phila. Med. Journal, Oct. 27, 1900.

2 The Etiology of Yellow Fever—An additional note, Journal Amer. Med. Association Feb. 16, 1901.

3 Experimental Yellow Fever, American Medicine, July, 1901.

bring into action for the prevention of the spread of this disease; since in dealing with the mosquito, we are dealing with the intermediate host which carries the specific agent from the sick to the well.

In considering, then, in a broad way, the prevention of yellow fever, the natural order would be to give our attention, first, to measures which will prevent the importation of this disease from infected places into the seaports of the United States; and secondly, to measures which will most effectually prevent the spread of this disease, provided it should gain a lodgment in one of the cities of this country.

With your permission, however, we will reverse the order of consideration above suggested, and will later refer in the briefest manner to the prevention of the importation of yellow fever into the United States from foreign ports, since this part of the subject will be presented by the health officer of the port of New York, who, from long experience, will be able to deal more intelligently than we with this part of the problem.

Since the mosquito, especially that species of *Stegomyia* which has recently been designated by Theobald as *Stegomyia Fasciata,* (formerly known to entomologists as Culex Fasciatus), has become so prominent a factor in the spread of yellow fever, it becomes necessary to consider this insect from the point of view of his identification; its habitat; its breeding places; the length of its generation; its hours of feeding; the influence of temperature upon both its propagation and stinging; the interval after contamination before the insect becomes capable of propagating the disease; the length of time during which it remains dangerous; the measures that should be used not only to protect the sick against the bites of these insects, but also to prevent the latter from infecting the healthy individual; and finally, a consideration of the several agents which may be successfully employed both to prevent the breeding of mosquitoes as well as directed towards their destruction in the adult stage.

Aside from the standpoint of scientific interest, it is certainly a matter of hygienic importance, in taking up the question of how to prevent the spread of yellow fever, when imported into the United States, that the health authorities of our several coast cities, and, indeed, of some of our inland towns, should be able to determine whether the only species of mosquito, which, up to the present time, has been shown capable of conveying yellow fever, is or is not present in these cities. If it should hereafter be proven that only species of the genus *Stegomyia* are capable of acting as intermediate hosts for the specific agent of yellow fever, as appears to have been demonstrated for the genus *Anopheles* in the spread of malaria, the presence or absence of the former genus will definitely determine whether yellow fever will or

will not spread in a given locality. The presence or absence of mosquitoes that can propagate the disease is the only intelligible explanation of what has heretofore been considered an inexplicable problem, viz., the capability of this disease to propagate itself in certain localities, while in other places it could be introduced with perfect impunity to the public health. In other words, our present knowledge of this question solves, at last, the problem of the portability or non-portability of yellow fever.

Description of Mosquito. The identification of *Stegomyia Fasciata* —Theobald—should not be difficult. This mosquito when examined closely with the naked eye and especially with a pocket lens, is a rather striking looking and handsome insect. Its most conspicuous markings are the broad semi-lunar silvery stripe which is seen on the lateral surface of the thorax, and the white stripes at the bases of the tarsal joints. These may be readily distinguished with the naked eye. The bands on the hind legs are especially well marked, and occasionally the entire fifth hind tarsal joint is seen to be of a pure silvery white. The four stripes of silvery scales which are seen on the posterior surface of the thorax serve to distinguish this species from all other mosquitoes, except *Stegomyia Signifer*—Coquillet—in which, however, as we have been informed by Mr. L. O. Howard, the curved thoracic band is very narrow and of a somewhat different shape. Examined with a hand lens, the four stripes are seen to consist of two lateral, distinct silver lines—the continuation of the semi-lunar, broad stripes—and two fine, white lines situated between these, and which require that the insect shall be held in the proper light, in order that these delicate threads may be distinctly seen. (Figs. I. and II.) The lateral surface of the thorax is also marked by several silvery dots and the abdomen by distinct white stripes. This description applies to both sexes. In the female, the palpi are short, as in the genus Culex. The proboscis is of a dark blackish brown color and is destitute of a whitish band near the middle. In the male, one of the front tarsal claws bears a tooth on the underside, while the other claw is destitute of such marking. In the female, both front tarsal claws bear a distinct tooth near the base of the underside of each.

Habitat. We have found this mosquito in all of the principal cities of Cuba, and have received specimens from a number of the smaller towns on this island. According to Howard[1] it has been found at Kingston, Jamaica, on the Isle of Pines, and at Bluefields, Nicaragua. He also reports that Theobold has received specimens of this insect from Italy, Greece, Spain, Portugal, Gibraltar and Malta. In the United States, Howard reports its presence at New Orlearns, Natchi-

1 Mosquitos, etc., by L. O. Howard N. Y, 1901.

FIG. I.—Stegomyia Fasciata—Female. a.—Front Tarsal Claw.

FIG. II.—Stegomyia Fasciata—Male. a.—Front Tarsal Claw.

tochez, and Napoleonville, La., in eastern Texas; Hot Springs, Arkansas; Pelham, Ga.; and from Virginia Beach, near Norfolk, Va. To this we can add Augusta, Ga., from which city we have recently received specimens of *Stegomyia Fasciata* through the courtesy of Dr. T. O. Oertel, of that city. Dr. Durham, of the English commission for the study of yellow fever, kindly showed us specimens of this insect which he had collected at Para, Brazil, and at various places along the Amazon river. It will be seen, therefore, that *Stegomyia Fasciata* has a wide distribution in the warmer countries of the globe, and especially at low altitudes. A more exact knowledge of the distribution of this mosquito in the United States is a matter of considerable practical importance.

Breeding Places. In our search for the larvæ of this insect we have found them in the following places: 1. In rain water barrels. 2. In sagging gutters containing rain water. 3. In tin cans that had been used for removing excreta and which still contained a small amount of fecal matter. 4. In cess-pools. 5. In tin cans placed about table legs to prevent the inroads of red ants. 6. In the collection of water at the base of the leaves of the *Agave Americana.* 7. In one end of a horse trough that was in daily use. It follows that *Stegomyia,* like *Culex,* will breed in any collection of still water, rain or hydrant, and that the presence of fecal matter does not seem objectionable. Indeed we have been in the habit of adding a very small quantity of the latter to our breeding jars, as it seemed to hasten the development of the larvæ. In water, however, which contains much suspended soil—muddy water—the larvæ, in our experience, do not flourish, but die off rather rapidly.

Deposition of Eggs. The insect lays her eggs during the night, and unlike *Culex,* which deposits its eggs in boatlike masses, *Stegomyia* extrudes her eggs on the surface of the water in pairs, in groups of three or more, or singly; in this respect resembling *Anopholes.* (Fig. III.) Exceptionally the eggs are deposited in a rather close-lying mass. (Fig. IV.) The whole batch is laid in one night or extending over two or three nights. The number of eggs deposited varies from about twenty to about seventy-five—rarely a larger number. Sixteen careful counts gave an average of forty-seven eggs. At the same time that the female deposits her eggs, she frequently, but not always, discharges a fluid which forms a very thin film over the surface of the water which possibly assists in floating the eggs. The latter are of a jet black color and, to the naked eye, cylindrical in shape, one end of the egg being rounded and blunt, while the other is slightly pointed, the whole resembling closely a Conchita cigar. They measure about .65 mm. in length by .17 mm. in width at the broadest part. Under a

low power, the surface of the eggs is seen to be marked by tolerably regular six-sided plates, each of which is further marked in the center by a little round elevation, which gives to the surface of the egg a decidedly roughened appearance. (Fig. V.) Under this low amplification it is also seen that while one side of the egg is somewhat convex, the other is flat or slightly concave, and that a cross-section of the egg would present the appearance of a triangle instead of that of a cylinder. This flattening of the surface of the egg does not appear to extend quite to the ends, which are round in shape. Although floating perfectly if left undisturbed, any agitation of the water, especially of a rough character, is apt to cause some or a majority of the eggs to sink. If by slight pressure the egg is pushed beneath the surface of the water, it at once sinks and does not rise again. This sinking of the eggs does not interfere with their subsequent hatching, as in our experience submerged eggs furnish about as many larvæ as those which are left floating on the surface.

The resistance of *Stegomyia's* eggs to external influences is worthy of note. Drying seems to be but little injurious to their subsequent fertility. We have found that eggs dried on filter paper and kept for periods of from ten to ninety days will promptly hatch when again submerged in water. Dried eggs brought with us from Havana in February, were easily hatched during the month of May in Washington, furnishing about 60 per cent. of the usual number of larvæ hatched from fresh eggs. Freezing does not destroy the fertility of the eggs, Although freezing with a mixture of salt and ice for thirty minutes has several times seemed to prevent subsequent hatching, on one occasion a batch of one hundred and fifty-five eggs, freshly deposited, which were frozen at a temperature of --17° C., for one hour, then thawed out at room temperature and placed in the incubator at 35° C., began to hatch on the sixth day; the majority furnishing active larvæ on the eighth day. In another observation, freshly deposited eggs, frozen at --17° C. for half an hour on two successive days, began to hatch on the third day as usual at incubator temperature. The resistance of *Stegomyia's* eggs to drying for a period of three months, would appear to demonstrate that this genus of mosquito could survive the winter in Havana, without the presence of hibernating females. Doubtless the genus is preserved in both ways. It is probable that the same could occur in our extreme southern latitudes.

Length of Generation. The impregnated female having obtained a meal of blood, proceeds to deposit her eggs, in captivity, after an interval varying in our experience from two to thirty days—as a rule, the eggs are laid within seven days—sometimes a second or third meal of blood is taken before any eggs are laid. Eggs placed under favor-

FIG. III.—Stegomyia Fasciata—Batch of 52 eggs as deposited by a single female—slightly enlarged.

FIG. IV —Stegomyia Fasciata—48 eggs, deposited in a close-lying mass—enlarged.

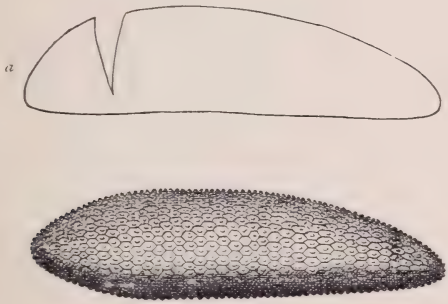


FIG. V. —Stegomyia Fasciata —Newly deposited egg. X 50 diameters. a. Empty shell from which larvae has escaped.

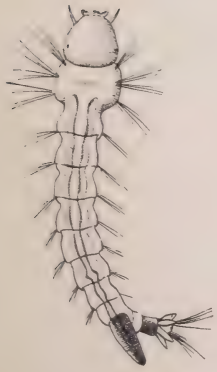


FIG. VI.—Stegomyia Fasciata—Full-grown larvae—enlarged.

FIG. VII. —Stegomyia Fasciata—Pupae—enlarged.

able conditions of warmth, *i. e.,* summer or incubator temperature, begin to hatch, as a rule, on the third day, the period extending to about one week. The larval stage requires seven or eight days and the pupal stage about two days. The period for the generation may be stated, therefore, as follows: Incubation, three days; larval stage, seven days; pupal, two days; total, twelve days. As the eggs begin to hatch before the expiration of the third day, we generally obtain a few mosquitoes on the eleventh day. The shortest period of development observed by us during summer weather in Cuba, was incubation, two days; larval stage, six days; pupal, thirty-six hours; making the total length of this generation, nine and one-half days. This short period, we believe to be quite exceptional. The first fully-developed insects begin to emerge on the eleventh or twelfth day, and the whole number have reached maturity by the fifteenth or eighteenth day after deposition of the eggs. The young larvæ, in emerging, rupture the shell at a point about one-fifth the length of the egg from the larger end. This cap-like end can be frequently seen turned back and still adhering to the rest of the shell. (Fig. VI.)

Influence of Temperature on Propagation. We have just seen that at summer temperatures, the time required for a complete generation of this insect is from eleven to eighteen days. We may say that at an average temperature of 75° F., or over, *Stegomyia* multiplies abundantly. Exposure to a cooler temperature, even for a short time daily, much retards the development of this mosquito. Thus a batch of fifty-one eggs kept at 35° C., but which were placed in a cool chamber at 20° C. for two hours daily during the whole process of development, although furnishing a few larvæ at the end of the third day, were not all hatched until the eleventh day. The first pupæ appeared on the fourteenth day and the first mosquito on the nineteenth day; the whole process being completed in twenty-seven days, instead of the usual fifteen to eighteen days. The loss of insects was about 50 per cent. Eggs kept at a temperature of 20° C. (68° F.) do not hatch, in our experience. Newly-hatched larvæ kept at this temperature develop very slowly and require about twenty days to reach the pupal stage. Mosquitoes developed under such conditions are feeble and but few arrive at maturity. Young larvæ kept at 10° C. (50° F.) have failed to reach the pupal stage—although some growth takes place. In one experiment more than 50 per cent. were dead at the end of two weeks, and none survived the thirty-second day. Half-grown larvæ and pupæ exposed to a temperature of 20° C., and even as low at 10° C., continue to slowly develop, but the few insects which escape drowning, have, as a rule, been of feeble strength and have refused to bite. Although the reduction of the temperature to the freezing point, or below, would not

necessarily destroy the vitality of the eggs of this genus of mosquitoes, it should be remembered that a reduction of temperature to 68° F., or below, for even a few hours of the twenty-four, will much retard the development of the generation. At a temperature less than 68° F. the eggs of this insect have ceased to hatch.

Influence of Temperature on Biting. While the non-impregnated female does not appear to bite, the impregnated female is generally ready to bite on the second or third day of her existence; they very rarely suck blood on the first day. This species of mosquito, when not deprived of its liberty, although occasionally biting during the morning hours, has, in our experience, been especially active from the hours of 4 p. m. till midnight. In captivity, the hungry impregnated female will bite at any hour of the day or night. The meal of blood appears to have been thoroughly digested on the third day, when the insects, if applied to the surface of the skin, can be again readily induced to feed. When freed in a room, the female does not appear to bite a second time till about five, or even seven days, have elapsed.

As regards the effect of temperature on the stinging of *Stegomyia Fasciata,* in our experience, the results of a number of observations show that this mosquito will bite at temperatures of 62° F. and above. At temperatures below this point, we have not, as yet, succeeded in inducing even very hungry females to suck blood. We may, therefore, say that observations thus far made appear to show that *Stegomyia Fasciata,* while not breeding at temperatures below 68° F., will still bite at a temperature as low as 62° F., but probably not at lower temperatures.

If this insect is concerned in the propagation of yellow fever, it is now quite apparent why an epidemic of this disease should fall to a low ebb in the city of New Orleans during the month of November, with a mean temperature of 61.8° F., and practically cease in December, with a mean temperature of 55.3° F. A careful study of the diagrams herewith submitted, (Figs. VIII and IX), showing the monthly mean temperatures of the cities of Havana, New Orleans and Rio Janeiro, together with the relative monthly mortality from yellow fever in these cities, will prove of interest, we think, as showing better than laboratory observations the general effect of temperature upon the breeding and biting of *Stegomyia Fasciata.* In the light of recent researches, we can now understand that while yellow fever can, and does, prevail during the entire year in Havana and Rio Janeiro—although at a comparatively low ebb during the winter months—it can not propagate itself in New Orleans from December to May.

Interval after Contamination before Mosquito becomes Dangerous. In our experimental work on human beings, we have not succeeded in inducing an attack of yellow fever by the bites of mosquitoes which

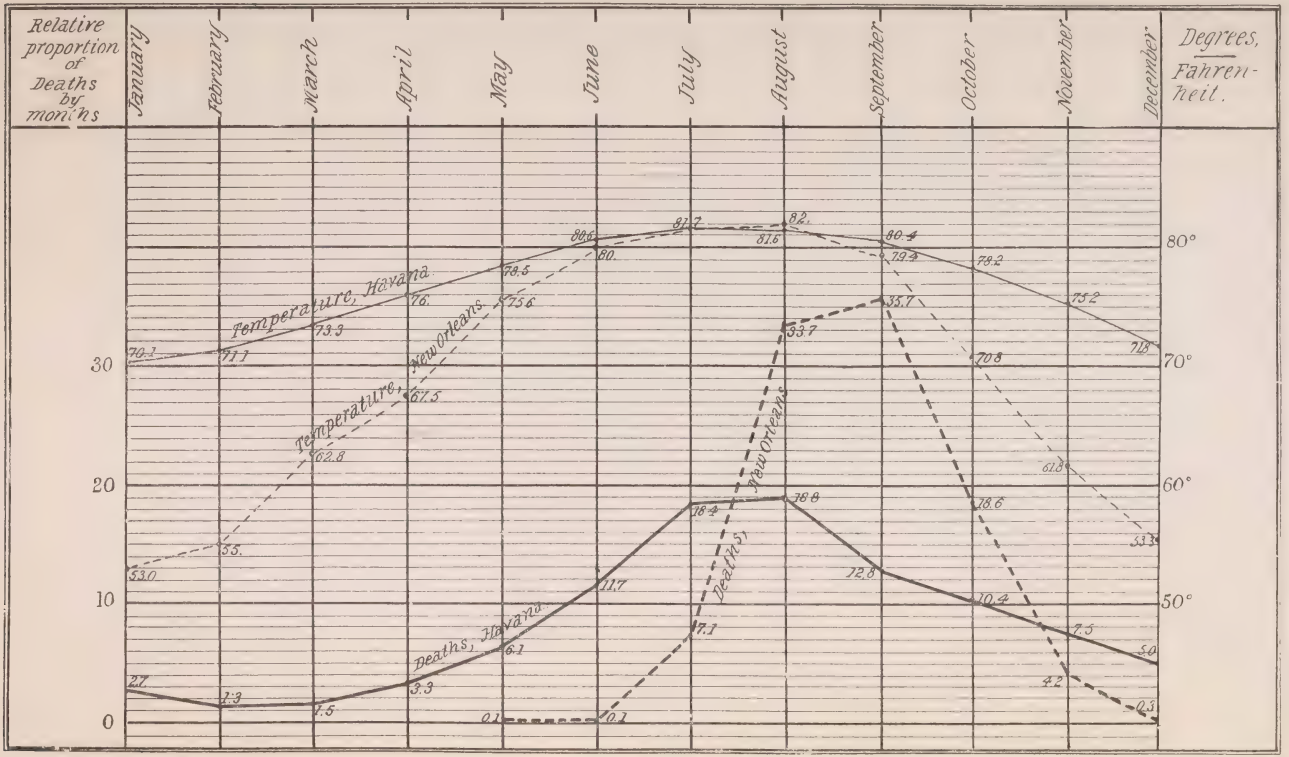


FIG. VIII. Diagram showing relative monthly percentages of deaths from yellow fever, and also mean monthly temperature for Havana and New Orleans.

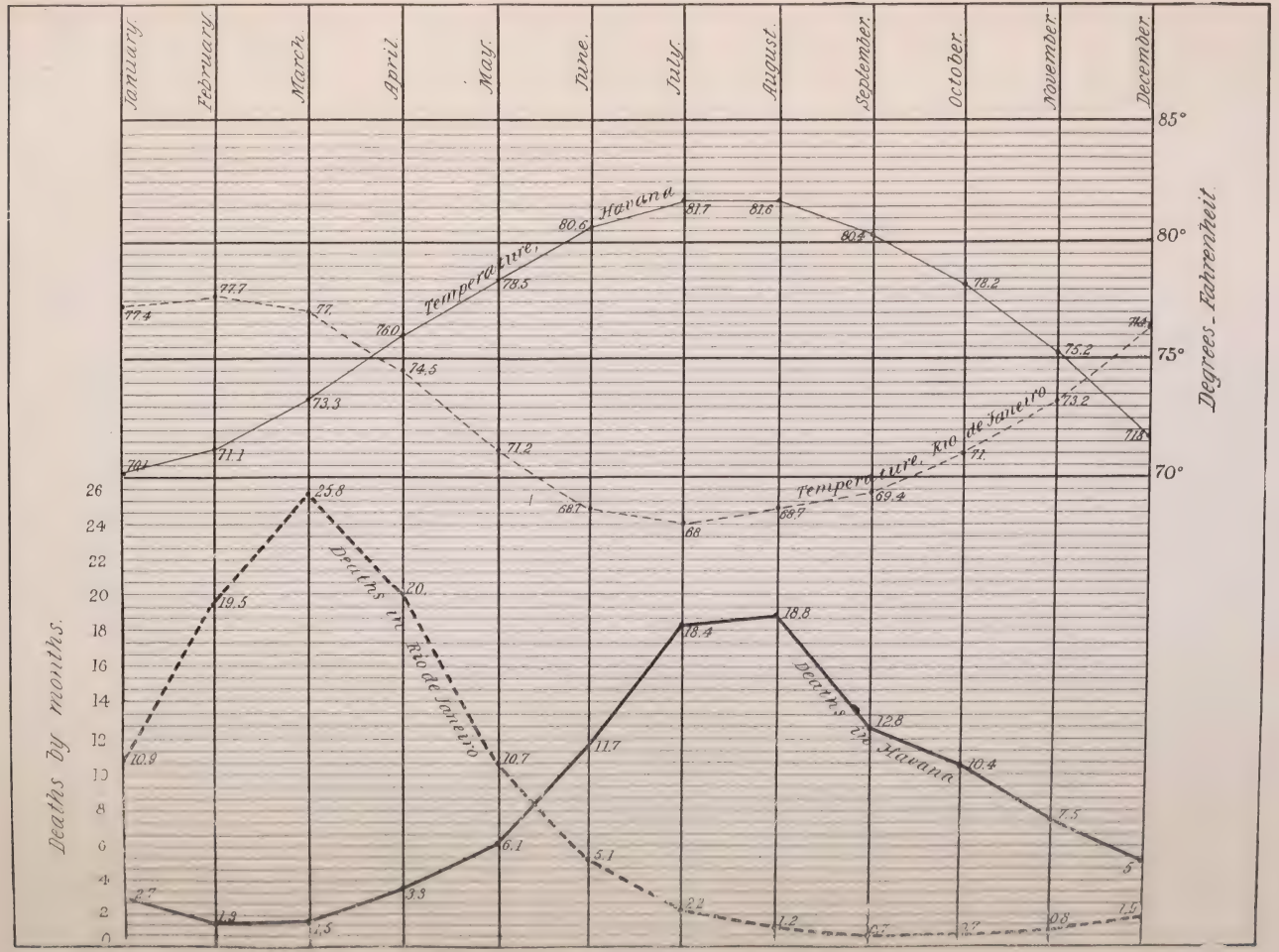


FIG. IX. — Diagram showing relative monthly mortality from yellow fever and mean monthly temperature for Havana and Rio de Janeiro

Havana, yellow fever, for the years 1890-1899. — Rio de Janeiro, yellow fever, 1851-1894.

had been kept less than twelve days after contamination. The same insects which failed to convey the disease on the eleventh day, were capable of so doing on the seventeenth day after infection. This interval of about twelve days, which appears necessary for the development of the parasite within the mosquito, plus the period of incubation, agrees with the time that has been observed to elapse between the introduction of an infecting case into a locality and the occurrence of the first secondary case, viz., two to three weeks.

After the mosquito has once become dangerous, how long it remains capable of conveying the disease, although important, has not been determined. We have reported cases of yellow fever caused by the bites of insects, at intervals varying from twelve to fifty-seven days after contamination. Here the dangerous interval was forty-five days, but as one of these insects lived until the seventy-first day after biting a yellow fever patient, the dangerous interval would here be prolonged to fifty-nine days, or a little over eight weeks. In our experience, the infected insect appears to live about as long as the non-infected mosquito, so that the answer to this question would depend upon the length of life of the mosquito. This we do not know. While in captivity, the majority of mosquitoes do not survive, with the best of care, more than about five weeks, and many die within half of this time. We are ignorant as to the length of time during which they may live when under natural conditions. Certainly during summer weather this will depend largely on the opportunity of obtaining access to water by the mosquito.

Measures to Prevent the Spread of the Disease when Imported. A case of yellow fever having been imported into one of our seaport cities, we are now prepared to discuss the measures that should be taken to prevent its spread. The problem resolves itself into the simple one of excluding mosquitoes from access to the sick individual and of destroying those insects that have already become infected. We can leave out of consideration any danger from wearing apparel or baggage, which may be dismissed as harmless.

The fear that has been entertained that infected insects may be imported in boxes or trunks, we believe to be absolutely groundless, and this for the simple reason, as shown by numerous observations made by us, that mosquitoes when deprived of water, die within a few days. Even if allowed to fill themselves with blood immediately before the experiment is begun, and then deprived of water, practically all are dead by the expiration of the fifth or commencement of the sixth day. We may say that of a large number of insects tried in this way, only one female has survived until the sixth day, and then in a feeble condition. Males and females which have been living on sugar and water,

or fed two days before on blood, if deprived of water and food, begin to die after twenty-four hours, and all are dead on the fifth morning. Free access to water, therefore, is necessary for the existence of this mosquito.

Add to the deprivation of water, the chance of injury to so frail an insect packed in with articles of clothing, etc., and we see that infected mosquitoes cannot be imported alive in baggage that has been five days en route.

As the first special measure of prevention then, we should give our prompt attention to the protection of the sick individual against the bites of mosquitoes. This can best be accomplished by thorough screening of the windows and doors of the room occupied by the patient without delay and with as little disturbance as possible, so that any insects already present in the room may be prevented from escaping. As it will not be feasible to make use of any of the destructive agents against mosquitoes already within the patient's room until recovery, every precaution should be used to see that the insects do not escape in opening and closing the door. Screens at windows should not, for this reason, be movable. As it is possible that mosquitoes that have already bitten the sick individual, may have escaped into other apartments of the house, these should be closed tightly and subjected either to sulphur or formaldehyde disinfection, or to the fumes of burning pyrethrum. According to Dr. Gorgas, the efficient health officer of Havana, preference is given to pyrethrum powder, burned in the proportion of one pound to 1,000 cubic feet of air space.[1] He, however, adds: "As the pyrethrum powder, even in this large quantity, does not certainly kill all mosquitoes, the room is opened at the end of three hours, and the mosquitoes on the floor swept up and burned."

We have mentioned above, in the order of their efficiency, the agents which are most destructive to *Stegomyia*. According to our observations, an exposure for one and a half hours to sulphur fumigation, in a well-closed room, in the proportion of one pound to 1,000 cubic feet of air space, will suffice to effectually destroy all mosquitoes. Formaldehyde gas is not quite so efficient. With Trenner's formaldehyde generator, charged with formalin, 900 c. c.; glycerin, 9 c. c.; methyl alcohol, 360 c. c., which we have found quite reliable for the destruction of bacteria, an exposure of not less than three, and preferably four hours, is required in order to kill these insects in a tight room having 2,800 feet cubic capacity. Pyrethrum powder, if burned in the proportion of four ounces to 1,000 cubic feet of air space will stupefy all mosquitoes at the expiration of one hour, so that they will fall to the floor in a helpless condition. If, used, however, the precaution above recom-

1 Medical Record, New York, Vol. 60 No. 10, September 7, 1901.

mended by Dr. Gorgas should be strictly followed; that is, the room should be opened at the end of three hours and all insects carefully swept up and burned. The practice of destroying all mosquitoes in adjoining houses, as carried out in the city of Havana, with such excellent results, we consider of the greatest importance, since only in this way can we hope to destroy infected mosquitoes and thus prevent the occurrence of secondary cases. In other words, relying upon the well-known slow progress of the spread of yellow fever, we seek to catch and destroy all mosquitoes within a given radius of the first case. If secondary cases should occur, the same hygienic measures should be rigorously enforced along the lines above indicated. Upon the completion of the case, the room occupied by the patient should be disinfected, and in a matter where so much is at stake, we believe that sulphur should be given the preference as a disinfectant. In case of death, the body should be carefully screened against mosquitoes, as *Stegomyia* will bite the dead body and might in this way acquire the parasite.

We have said nothing about the protection of non-immune individuals who enter the patient's room or house, since if the case under consideration is the infecting case, no danger is incurred. As the duration of the attack is short, generally less than ten days, the patient's room will have been disinfected and the infected mosquitoes destroyed before they have become susceptible of conveying the disease to others. We desire to emphasize the fact that the interval elapsing between the infection of this mosquito by biting a case of yellow fever and the time when it has become capable of conveying the disease, viz., about twelve days, is of the utmost importance in our efforts towards stamping out yellow fever at its very commencement, since it furnishes a non-dangerous interval during which all infected insects should be easily destroyed. It thus makes the control of yellow fever, hereafter, a simpler and more certain matter than the suppression of an outbreak of any of the other acute infectious diseases. If non-immunes entering an infected house desire protection against the bites of *Stegomyia*, this may be obtained by rubbing all exposed surfaces of the body, including the ankle surfaces, with spirits of camphor, oil of pennyroyal, or a 5 per cent. menthol ointment. The protective effect of these substances, is, however, only temporary.

What we have already said concerning the breeding places of *Stegomyia Fasciata*, should sufficiently indicate the general hygienic measures that should be taken in order to prevent the spread of yellow fever. These should consist in enforcing such measures as will effectually destroy the breeding places of this very domestic mosquito. The methods adopted by the chief sanitary officer of Havana, during the

present year, may be taken as a model by our sanitary officials. It should not be forgotten that a well-drained and well-sewered city, with a pure-water supply, has no protection against the spread of yellow fever, provided rain-water barrels and other collections of water are present, in which *Stegomyia* may breed. In one of the forts, on the outskirts of Havana, which was otherwise in an excellent sanitary condition, we found thousands of *Stegomyia Fasciata* breeding in tin cans placed about the legs of a table in an officer's kitchen. Our conceptions of yellow fever, therefore, as a "filth" disease must be abandoned, and our attention turned to yellow fever as a mosquito-borne disease. In illustration of what may be accomplished by sanitation based on the latter method of propagation, we present herewith a chart (Fig. X.) showing the actual monthly mortality from yellow fever in Havana, for the period 1880-1899, and also, for the years 1900 and 1901. Comparing the mortality from this disease for the year 1899, which was the most favorable year for yellow fever that Havana had experienced in twenty years, with the year 1901, during which sanitation, based on the demonstration that yellow fever is propagated by the mosquito, has been enforced, we find a reduction in mortality of 83.3 per cent. in favor of the present epidemic year (April 1st to August 31st); or if we compare the mortality for the epidemic year 1900, with the present year, we observe a still greater reduction in favor of the latter, viz., 411 per cent.

The sanitary regulations put into force February 15, 1901, by Dr. Gorgas, resulted in freeing Havana from yellow fever within three months, so that for a period of fifty-four days—May 7th to July 1st—no case occurred. On the latter date, the disease was brought into Havana from Santiago De las Vegas, and according to Gorgas, has been introduced into the city at least a dozen times from this and other sources. In spite of these new sources of infection, July has only furnished four cases, with one death, and August eight cases, with two deaths. If such admirable results, under new methods of sanitation, have been obtained in this hot-bed of yellow fever, we cannot believe that the intelligent and efficient boards of health of our cities will again permit this disease to assume an epidemic form in any city of the United States.

Measures Directed Against the Importation of Yellow Fever into the United States. Under the admirable system of inspection and reports, as carried out by the Marine Hospital Service, the appearance of yellow fever at any foreign port is promptly reported, for the information of the health authorities of our several Atlantic ports. We may, therefore, divide foreign ports within the so-called epidemic zone into (a) infected, and (b) non-infected ports. Heretofore no distinction has

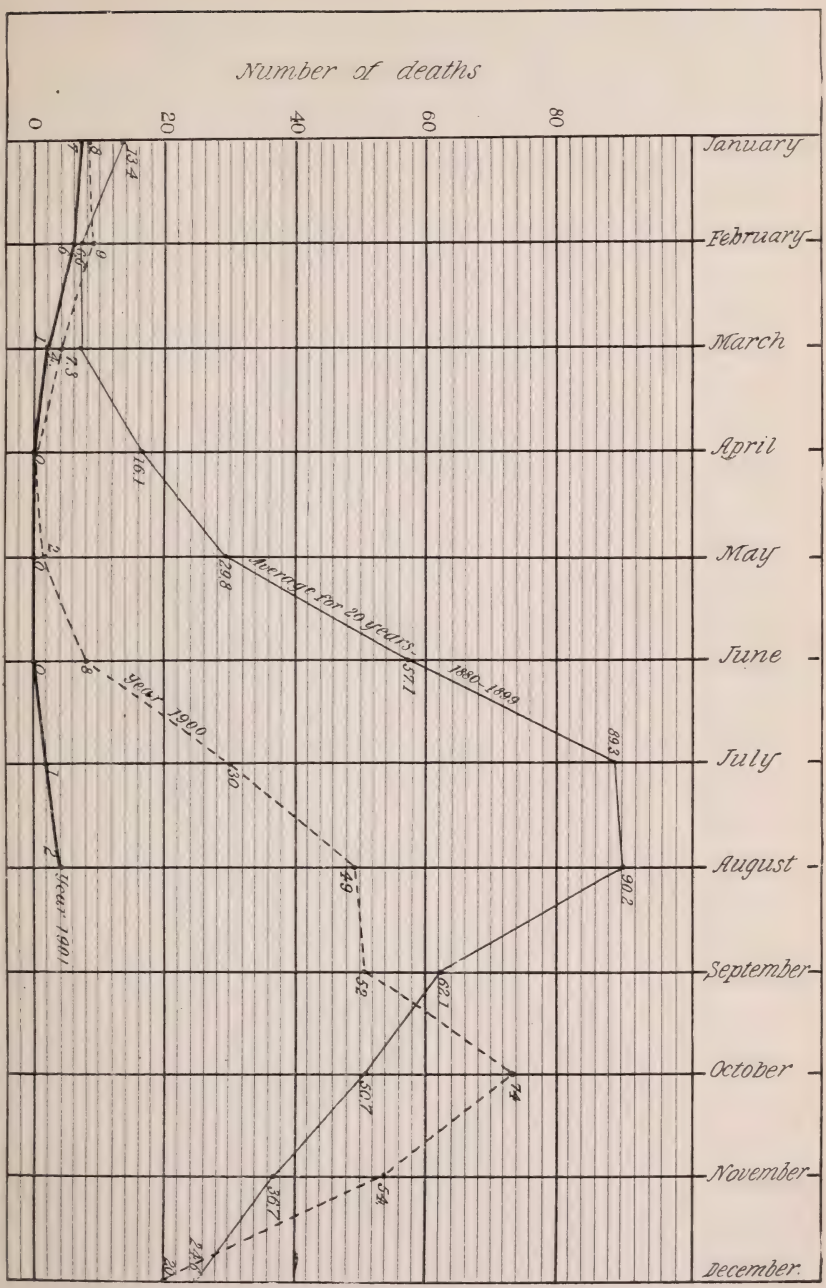


FIG. X.—Diagram showing average monthly mortality from yellow fever in Havana for period 1880-1899, and from January 1st to August 31st, 1901.

been made by the health officers of our southern ports, as regards quarantine regulations, from April 1st to November 1st, between infected and non-infected places. All ports within the epidemic zone of yellow fever were considered as being infected places, and hence passengers and vessels were subjected to quarantine and to disinfection of both baggage and cargoes.

With our present knowledge of the way in which yellow fever is propagated, we believe that in the treatment of passengers, as well as of cargoes, a sharp distinction should be made, first, between infected and non-infected ports; and secondly, in the case of vessels sailing from infected ports, between those that have received their cargoes and passengers in mid-stream and those that have loaded at the wharf.

We believe that no quarantine restrictions should be placed upon either passengers or cargo from non-infected ports. In the case of a vessel loading in mid-stream at an infected port by means of lighters, we believe that she can only receive infection in one way, *i. e.*, by passengers who have been exposed to yellow fever on shore and who coming aboard may thereafter be seized with the disease. The possibility of infected mosquitoes reaching the vessel either by flight or by means of lighters may be dismissed.

Vessels, loaded under the foregoing circumstances and arriving at our ports without yellow fever developed en route, should have their non-immune passengers quarantined for five days, counting the time consumed by the voyage as part of the quarantine period, and should be allowed to discharge their cargoes without delay. If the disease has developed en route amongst crew or passengers, the sick should be promptly removed; the forecastle or staterooms as the case may be, disinfected with sulphur or formaldehyde gas, and the vessel allowed to proceed to the wharf.

On the other hand, if the vessel has received her cargo at the wharf of an infected port, there is a possibility that she may have received infection in three ways: First, either by contaminated mosquitoes that have bitten a case of yellow fever in the immediate vicinity on shore; secondly, by mosquitoes that have become infected from biting a yellow fever patient present on another vessel loading at the same, or at an adjacent wharf; or third, by some individual who has acquired the infection on shore and afterwards taken passage on the vessel.

In our opinion, however, the chances of infection of a vessel by contaminated mosquitoes coming aboard from a house or ship in close proximity are very slight; although such a possibility must be admitted, and the further possibility that recently infected mosquitoes may have sought refuge on the vessel during the night preceding her day of departure. It is also possible, that a case of mild, and hence undetected,

yellow fever may occur on board, and be the source for the infection of mosquitoes already present in the vessel.

Under these circumstances, if a sufficient number of days have not elapsed between her port of departure and port of arrival in the United States, that is, sixteen to twenty days—to demonstrate the presence of infected mosquitoes, by the occurrence of a case or cases of yellow fever en route, we know of no way of absolutely excluding the possibility of importation of the disease by such a vessel, than by the detention of all non-immune passengers for such number of days as will show their freedom from infection, and by careful disinfection of crews and passengers quarters.

If more than twenty days have elapsed during the voyage, without the occurrence of yellow fever, neither passengers nor vessel should be detained.

We have said nothing about the disinfection of the vessel's cargo for the reason that we do not consider this to be necessary. The only possible excuse for subjecting the cargo to disinfection would be the fear of the presence of infected mosquitoes in the vessel's hold, provided she had loaded at the wharf of an infected port. In this instance, if the voyage has consumed five or more days, all mosquitoes contained in the hold will have died, for, as we have already pointed out, *Stegomyia Fasciata* lives only a few days, if deprived of water. We cannot too strongly insist that the danger of importation of yellow fever into the United States lies, not in cargo or personal baggage, but in the individual sick with that disease. With our present knowledge of its propagation, personal baggage should no longer be subjected to disinfection and, with our increased ability to prevent its spread by measures easy of application, instances should be few and exceptional when a vessel coming from a yellow fever port should be delayed longer than will be necessary to remove her non-immune passengers who have not yet completed their period of five days since leaving the port of departure.

The chief duty of quarantine officers hereafter will lie in the detection of mild or very mild cases of yellow fever. In a series of twelve cases of experimental yellow fever produced by the bite of *Stegomyia Fasciata*, we have, elsewhere,[1] pointed out that four, or 33 per cent., were mild or very mild in character, and have indicated the difficulty of making a positive diagnosis in such cases.

In discussing the period of incubation of experimental yellow fever, we have shown that in 16.6 per cent. of our cases the period of incubation exceeded the usual quarantine period of five days. If we add Carter's cases to those observed by ourselves, we find that of twenty-

[1] Experimental Yellow Fever—Transactions of the Association of American Physicians. Vol. XVI, 1901.

four cases the period of incubation exceeded five days in three, or 12.5 per cent.

We can thus readily see what great danger heretofore lay in the passage through quarantine of just such mild cases, or of those having an incubation stage of more than five days.

While the exclusion of such cases is of the greatest importance, we doubt whether with our improved knowledge of how to prevent the spread of yellow fever, it would be advisable to place a greater burden upon ships' passengers by extending the quarantine period to more than five days. It appears to us rather that in view of the troublesome delays to which passengers and vessels from yellow fever ports have been subjected in the past, the time has now arrived, when standing upon more solid ground, we will be justified in seeking in every way to lessen, as much as possible, the restrictions placed by present quarantine regulations upon the ship's cargo, while we add nothing to those of the passenger.

To this end, a most important part will have been accomplished, if we can persuade the sanitary authorities of our sister Republic, Mexico, and of the Central and South American States, to join us in the adoption of more enlightened methods for the suppression of this widely-prevalent epidemic.

THE RESULTS OF YELLOW FEVER SANITATION IN HAVANA, CUBA, FOR THE YEAR 1901 UP TO SEPTEMBER 1st, CARRIED ON UPON THE BASIS THAT THE STEGOMYIA MOSQUITO IS THE SOLE MEANS OF ITS TRANSMISSION.

By W. C. GORGAS, M. D.,

Major and Surgeon U. S. Army, Chief Sanitary Officer, Havana, Cuba.

The results announced by the Yellow Fever Commission, of which Major Walter Reed was President, and which met in Havana in the fall of 1900, were accepted as conclusive by the Sanitary Department of that city. After a series of experiments, the Board succeeded in demonstrating that the mosquito is the medium for the transmission of yellow fever, and upon this fact has been based all our methods of sanitation, since February of this year, when the conclusions of the Board were made known.

Accepting these as facts, it is evident that two elements are necessary for the transmission of yellow fever, viz.: First, a non-immune person who is capable of having the disease; second, infected mosquitoes, by which the disease may be transmitted to the non-immune.

In Havana, the problem of the person capable of having the disease is quite different from the problem which presents itself in the United States. In the United States practically the entire population is susceptible to yellow fever, while in Havana we have about 230,000 persons who are not subject to the disease, and only about 30,000 who are. If we could take these 30,000 away from Havana, and prevent non-immunes going in, the problem would at once be solved and yellow fever be eradicated from the city. But it is, of course, impracticable to move out and care for so large a number of people; and to prevent the coming into the city of non-immunes would too seriously interefere with the commerce of the city.

A close supervision is, however, exercised over the large number of immigrants who arrive at this port. They are all taken to the immigration station and those intending to settle in the country are sent directly to their destinations without coming into Havana. Those coming into the city have to be vouched for by some reliable person, known to the immigration authorities, so that they can be followed up in case of need. They are required to matriculate at one of the hospitals for two months, with the expectation that, as their fees at these hospitals are paid, they will go there at once in case of sickness.

In the smaller towns, the deportation of the non-immunes is the method principally relied upon for the stamping out of yellow fever. It has been entirely successful and satisfactory in the past.

Where the non-immunes amount to only a few hundred, as at Santiago in 1899, and at Quemados in 1900, a camp is established at some convenient and healthy point, and all the non-immune population moved to this camp. In the two instances cited, the epidemic was at once cut short in midsummer by this measure.

Instances of epidemics in military garrisons being stopped in this way are very numerous. It has been resorted to many times in the army during the past twenty years, and in Cuba wherever it was evident that a garrison had become infected.

But even with non-immunes in a community, to have yellow fever there must be present infected mosquitoes, and infected mosquitoes presuppose the previous existence of mosquitoes in the locality. It is obvious that if we can exterminate all mosquitoes we will be as free from yellow fever as if we had no non-immunes present. So, early in the season, we directed our energies towards the destruction of the mosquito.

For this purpose, a division of forty men has been organized; the city divided up into districts, and a foreman and two laborers designated for work in each district. They make daily house-to-house inspections, visiting each house in the district once in three weeks. Each laborer is supplied with oil, and a half pint is poured into each "pozo negro"; these connect with the cesspools with which all houses in Havana are provided, in the absence of any general sewer system; and this oil spreads over the surface of the cesspool and kills the larvæ, which breed there in large numbers. Oil is also poured onto the surface of any water to which mosquitoes have access. About 2,000 gallons of oil a month are used in this part of the work.

It was found that nearly every house was provided with some receptacle for rain water for washing purposes,—chiefly water-barrels,—and the fresh standing water was the best possible breeding place for the *Stegomyia*—the yellow fever mosquito.

The mayor then issued an order that all barrels containing standing water should be made mosquito-proof; where this order is not complied with, the inspectors are instructed to break the barrel. This has had an excellent effect, and the order is now complied with in nearly all cases.

A second division, composed of fifty men, was organized, who are at work cleaning out the ditches, drains and streams around the city, draining low places wherever stagnant water is breeding mosquitoes;

and if drainage is impracticable, keeping the surface of the water well oiled.

The results have been very satisfactory, considering the short time during which this work has been in progress. But it is quite certain that our efforts could not entirely destroy mosquitoes in Havana; the best that can be done is to reduce the number.

The next logical step was to prevent the mosquito from becoming infected; and the first move in this direction was to make it impossible for the mosquito to bite any one suffering from yellow fever in Havana. With this object in view, as soon as a suspicious case of fever is reported to this office, the apartments of the patient are at once screened with wire screen doors and windows, which this department keeps on hand for the purpose, and which render the patient absolutely mosquito-proof. A guard is placed to see that the wire doors are kept closed and that no one goes in except certain immunes designated. The hospitals, also, are required to have their yellow fever wards made mosquito-proof, and the patient kept under mosquito bars. Circulars recommending the use of mosquito bars have been very generally distributed in the city, and the object explained.

Since, in these suspected cases, it is possible that mosquitoes may have become infected before the patient is screened, the disinfecting squad carefully goes over every room in the house; they are sealed, the cracks pasted and pyrethrum powder burned at the rate of a pound to 1,000 cubic feet of air space. As pyrethrum powder, even in this quantity, frequently fails to kill all the mosquitoes, many being found on the floor stupefied, when the rooms are opened, at the end of three hours, those on the floor are killed, swept up and destroyed. The two or three adjoining houses are gone over in the same way,—to be certain that all infected mosquitoes in the neighborhood are killed.

Pyrethrum powder is used because it is not disagreeable and does not injure any fabric. Where nothing could be injured, sulphur is used, as it is more certain in its effects.

To prevent yellow fever from being introduced from outside the island, the Marine Hospital Service carefully supervises all arrivals from points from which infection might come.

To protect the city from interior towns, inspectors are placed on all roads entering the city, who take the names of non-immunes coming in, and the address of the house at which they will stop. These are reported to the Sanitary Department and an inspector is sent on the third and sixth days to see if they continue in good health. At the same time, blanks are left with them, and they are requested to send a report on these blanks to the Sanitary Department, in case they become sick. At the end of six days this supervision ends.

We began the year with the usual amount of yellow fever in the city; in January there were twenty-five cases and seven deaths, and for February up to the 16th, four cases and three deaths. On February 16th, the present method of disinfection was adopted; after that time, we had cases on the 22d, 23d and 27th of February, and on the 2d and 8th of March. In all these cases the above described method of screening and disinfection was strictly carried out, and no more cases occurred until April 21st and 22d, when two developed. Again we were free from fever until May 6th and 7th, when four cases occurred.

From that time until July 1st, the city was entirely free of fever. During July, we had four cases, occurring on the 1st, 20th, 21st and 24th, with one death, and in August eight cases; one case taken sick July 27th and died August 5th, the others taken sick August 10th, 16th, 20th, 21st, 24th (two), and the 25th; with two deaths.

Taking the yellow fever year as beginning April 1st and comparing the record of this year with that of preceding years since 1889, we find:

DEATHS OF YELLOW FEVER IN THE MONTHS OF APRIL, MAY, JUNE, JULY AND AUGUST.

Months.	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901
April	13	5	8	8	4	6	14	71	1	2	0	0
May	23	7	7	23	16	10	27	88	4	0	2	0
June	38	41	13	69	31	16	46	174	3	1	8	0
July	67	66	27	118	77	88	116	168	16	2	30	1
August	60	66	67	100	73	120	262	102	16	13	49	2
Total	201	185	122	318	201	240	465	603	40	18	89	3

The conditions in Havana this year as regards non-immunes were more unfavorable than at any previous time,—there being probably more present than in any of the years with which comparison is made. Infection was also present, as evidenced by the continued appearance of new cases of fever.

As I have stated above, these are the two requisites for the transmission of yellow fever, and yet the records show a condition as regards yellow fever never before seen in Havana.

As killing off infected mosquitoes is the only thing done now which was not done during previous years, and the other conditions being practically similar, I think we may fairly infer that we owe our present immunity to the destruction of the mosquito, both before and after infection.

We have a well-equipped hospital, to which all yellow fever patients may go, if they desire it. Dr. John W. Ross, of the U. S. Navy, is in immediate charge, with a corps of American trained nurses under him, and the patient receives the same care that any New York hospital would afford.

PRACTICAL DISCUSSION OF YELLOW FEVER.

By Dr. ALVAH H. DOTY,

Health Officer Port of New York.

The stimulus which has been given to the study of infectious diseases from a scientific and practical standpoint, and which during the past fifteen or twenty years has furnished us with much definite and reliable information on this subject, has now, through the experiments of Dr. Walter Reed and his colleagues, presented indisputable evidence as to at least one of the means by which yellow fever is transmitted. It is in connection with this that I desire to present the practical side of the subject in order that it may be viewed from all points and that it may aid us in arriving at some definite conclusion regarding the treatment of yellow fever and of vessels and persons arriving from ports infected with this disease.

The history of yellow fever in the United States and elsewhere has shown that it is usually confined to geographical limits, and that sections beyond these are as a rule free from the disease, although it has occasionally appeared outside of the yellow fever zone. For instance, between the years 1798 and 1805, many cases of yellow fever occurred in New York, first appearing at the lower end of the city in the vicinity of Peck Slip. Medical history indicates that the disease had shown itself here before that time, but it was not until the period I refer to that it was fully recognized and studied. I have been fortunate enough to secure a copy of the official medical statements relative to these outbreaks, and the opinions which are expressed are in such harmony with the conclusion of modern sanitarians that I submit the following extracts:

Dr. James Hardie, who in 1822 published an official account of these outbreaks, says in reference to cases of yellow fever at Bellevue Hospital in 1798:

"There is one thing very remarkable, with respect to the attendants of this hospital, which ought not to be omitted. Their situation, to most people, must have, no doubt, appeared peculiarly dangerous, as they were literally surrounded by pestilence. It so happened, however, that neither physicians, nurses, nor washerwomen caught the infection. The boatmen, too, belonging to the Health Office, who enter the hospital at all times, and were not only engaged in bringing the sick from the city and shipping, but, likewise, in removing them

from place to place, enjoyed a uniform state of good health; and of those persons who accompanied their friends and relations, stayed with them, and nursed them, there is not a single instance of an individual being infected. In short, Dr. Douglas, one of the assistant physicians, was the only person, residing there, who was seized with fever; but he had been in the habit of occasionally visiting his friends in the city and three days previous to his being taken ill had slept in a house the vicinity of which was highly infected, and it is more than probable that his sickness was occasioned by that cause."

The following extract is taken from the official report of the resident physician at the Marine Hospital on Staten Island regarding the outbreak of yellow fever in 1799:

"During the months of July, August, and October (1799), there were in all about two hundred and fifty (250) persons sick of yellow fever in the Marine Hospital, a great part of whom were from the shipping; the rest from the city. At that time, there were of physicians, nurses, washerwomen, boatmen, and my family, composed of myself, my wife, and three children, thirty-seven (37) persons, not one of whom, although daily and hourly amongst the sick, experienced the least indisposition."

From the official communication addressed to Governor Lewis, January 12, 1806, by Dr. Edward Miller, resident physician of Bellevue Hospital, I quote the following:

"No communication of the disease was ever observed in yellow-fever hospitals, situated at a distance from the cities to which they belong. No exception to this has ever occurred in any of the numerous seasons of this pestilence, at our hospital, at Bellevue, the Marine Hospital on Staten Island, that of Philadelphia, or any other in the United States, provided the malignant air of the city had been avoided. The force of this fact seems never to have been duly considered or appreciated. The numerous retinue of medical attendants, nurses, washerwomen, servants, etc., which belong to our hospitals, must be known to everybody. How greatly they are exposed to contagion, if it could be supposed to exist in this case, is equally known. The most malignant cases of the disease are constantly found in these institutions. The exposure of physicians and their assistants is well understood. The duty of the nurses leads to an incessant and unreserved intercourse with the sick; they sleep and pass the greater part of their time in the apartments of the sick, the dying, and the dead.

"The nurses at Bellevue Hospital became so entirely free from all apprehensions of the contagiousness of this disease that they often slept on the same bed with the sick, and it happened more than once, in the course of the season, that a nurse, overcome with fatigue and want of sleep, threw herself in the night, for a little repose, on the

bed of a dying patient and continued there asleep until the patient was dead, and it became necessary to remove the corpse."

The official reports from which I have just quoted contain many statements similar to the above.

Fifty years after these statements were made, a most notable congregation of sanitarians took place in New York City (1859) under the name of the Third National Convention. After a most careful and exhaustive discussion of yellow fever, the following resolution was passed by a vote of eighty-five yeas to six nays:

"*Resolved*, That in the absence of any evidence establishing the conclusion that yellow fever has ever been conveyed by one person to another, it is the opinion of this convention that the personal quarantine of cases of yellow fever may be safely abolished provided that fomites of every kind be rigidly restricted."

To what I have presented above, I shall add my personal experience with this disease, and with persons and vessels arriving from yellow-fever-infected ports. This experience, which covers a number of years, is in full accord with the previous records of the New York Quarantine Station. Its special importance lies in the fact that probably more than one-half of all foreign vessels coming to the United States reach the port of New York, which is in daily communication with yellow-fever ports.

For the purpose of better studying the statistics which I am about to present, it will be necessary to divide the vessels arriving at New York from yellow fever ports into two classes: (1) Those which are a week or less in transit, such as vessels from Cuban, Mexican, and Central American ports, and (2) vessels coming from ports far away, as Santos and Rio Janeiro (Brazil), which are three weeks or longer in passage. In the first class are found the greater number of vessels, and those with which we come in daily contact. These include both passenger and freight boats. The vessels from Havana, the most numerous, and on which we have heretofore found a large percentage of the yellow fever reaching this port, are from three to five days in transit. While at Havana they do not, as a rule, approach the docks, but discharge and receive their passengers and cargoes in the open bay. A still further restriction has been made. I have recommended that the crews of these vessels be detained on board and not allowed to go ashore. Some of the fast mail steamship lines carrying passengers have made this a rule of the company, and have required its strict enforcement. Vessels from Mexican and Central American ports, which are included in the first class, are about one week in transit to New York.

The yellow fever patients removed from these vessels have in every instance been taken sick within five days from the time of departure

from the infected port; a large percentage of them showed the first symptoms of the disease during the first forty-eight hours, and some have stated that they were not feeling well at the time of embarkation. As a rule, these cases were found among the second cabin or steerage passengers, and although there was free exposure, in no instance has a secondary case ever occurred. I want to emphasize my statement regarding the exposure, as in the cases referred to it was practically unlimited. Sometimes the disease was not recognized, and the patient remained in the same apartment with others during the entire voyage; at other times, although the patient may have been removed to other quarters, passengers or members of the crew were detailed to care for him, as these vessels do not, as a rule, carry surgeons. The exposure was not only to the patient, but to his clothing, bedding, and discharges also. In instances where a member of the ship's crew contracted yellow fever, it was found that the patient had been on shore, but in no case, so far as I know, has the disease ever occurred among crews which have been kept on board vessels anchored in the bay of Havana. I have no reason to believe that members of the crews of Colon vessels are kept on board during the time that they are in that port. However, I am aware of no case which has occurred among them. This is easily explained by the fact that Colon, in recent years, has been free from yellow fever, and cases of this disease which vessels from Colon bring to the United States are from Panama, about thirty-five miles distant on the opposite side of the Isthmus.

Vessels coming from Rio Janeiro and Santos may be taken as examples of the second class, which are long in transit. These ports are notorious for the prevalence of yellow fever, the bills of health having frequently shown the existence of four hundred to five hundred cases at one time. Some of the vessels from these ports carry passengers and have medical officers—the majority, however, do not. It is not uncommon for the captain or surgeon to report that while at Santos or Rio Janeiro, or within two or three days after leaving, a passenger or member of the crew became sick with symptoms clearly indicating yellow fever, and either died and was buried in port or at sea, or recovered. Their report also shows that in no instance were these followed by secondary cases after the boat had been five days at sea, although there was full exposure and no disinfection. But in no instance has a case of yellow fever been found on a vessel reaching here from these ports. This can easily be accounted for, as all who had yellow fever on these vessels were taken sick at Santos or Rio Janeiro, or within three or four days from departure, and either died or recovered long before the vessel reached this port, the voyage being about twenty-one days. Whereas, cases occurring on vessels of the first class reach here during the active

stages of the disease, neither have secondary cases ever occurred among those connected with the Swinburne Island Hospital in New York Bay, to which place all persons suffering with yellow fever are transferred from incoming vessels.

A careful analysis of these statistics clearly show that secondary cases have not occurred as the result of exposure to those who have contracted yellow fever in the infected area or to their clothing, bedding, etc., and that where persons have reached New York and are well after having been five (5) days or more from the port of departure, they have not afterwards developed the disease. Inasmuch as passengers and crews arriving on incoming vessels which have yellow fever on board are not detained at this station if they are well and have been five days from a yellow fever-infected area, it is naturally asked, how can I be certain that mild cases at least may not develop after they have left my jurisdiction? My answer is this: First—If secondary cases occurred as the result of personal contagion, or exposure to clothing, bedding, etc., there would be many of them, as there is full exposure—furthermore cases occurring as the result of this exposure would not all be mild, and some would surely present themselves in a typical and fatal type. If this occurred in New York City, or elsewhere, it would be known and the disease traced to its origin. Second—Those who are removed at this port sick with yellow fever are as a rule second-class or steerage passengers, and their apartments are on the same deck and in constant communication with the crew of the vessel and entirely separate from the cabin passengers who are on the deck above. Therefore the exposure is largely confined to the crew, who are frequently detailed to look after the sick and therefore are in close contact with the patient—moreover members of the crew are often detailed to look after those sick with the disease, and in this way freely handle the clothing, bedding, etc. The crews of the vessels upon which the cases are usually found are as a rule permanently employed by the companies, and although they visit their home while the vessel is in this port, they return again to the ship before sailing. If they were confined to their homes with yellow fever, or any disease resembling it, or were taken sick in transit to Havana, it would sooner or later be brought to my attention. Third—We have the experience of sanitarians during many years past to show that yellow fever is not transmitted by personal contagion, or by exposure to the clothing, bedding, etc., of those sick with this disease.

When we study the practical experience which I have just presented and which comes to us from different periods during the past century, we can reach but one conclusion, *i. e.*, that yellow fever is not contracted by personal contagion. This, however, is not by any means all

that it shows, as the same evidence just as clearly proves that the clothing, bedding, discharges, etc., are not media of infection. If those who are in constant attendance upon persons suffering from yellow fever, and are in close and prolonged contact with their clothing, bedding, discharges, etc., at all times and under all conditions are not infected through the medium of this material, when does it transmit infection? In order to make these views acceptable from a practical standpoint it has been necessary to show in what way, other than through the affected person, or his clothing, bedding, etc., yellow fever is transmitted. It would seem that the experiments of Dr. Reed have furnished this information, inasmuch as the result of his work conclusively shows that the disease is transmitted by the mosquito and not by clothing, bedding, etc. This is in exact accord with our practical experience.

To those who have had but little practical experience in this matter, or those who live within the yellow fever zone, where extreme measures have been regarded as necessary to prevent the appearance or extension of yellow fever, this view carries with it such a complete and abrupt change in the treatment of yellow fever, as well as persons and vessels arriving from yellow fever ports, that it can hardly receive unbiased consideration.

The opposing views regarding the means by which yellow fever is transmitted may briefly be summed up as follows: On the one hand, we have conclusive evidence, as the result of practical experience and scientific investigation, that yellow fever is not contracted by personal contagion, or by the clothing, bedding, discharges, etc., of persons suffering with this disease; furthermore, there is positive proof that yellow fever is transmitted through the medium of the mosquito. On the other hand, those who hold that the disease is transmitted either by personal contagion, or by the clothing, bedding, etc., of the sick, have had but little to support their theory aside from the fact that the true cause of infection was unknown. The result of the Havana experiments leaves practically no further justification for this belief.

I am well aware that from time to time evidence has been presented, which is intended to conclusively show that yellow fever is contracted by personal contagion, or through the medium of clothing, bedding, etc. In considering this, we must bear in mind that heretofore we have had no positive evidence as to the means by which yellow fever is propagated, and all have been free to form their own ideas regarding this subject, and very naturally persons, or clothing, bedding, etc., have been accepted as the medium of infection. However, I believe that it is pertinent to ask if, in the instances just referred to, the presence of the infected mosquito would not afford a full explanation for the appearance of the disease. Furthermore, do we not fully appreciate

the danger from mild or unrecognized cases as the cause of outbreaks not only of yellow fever, but also other infectious diseases, nor is it fully understood how frequently such mild cases occur. Again we do not consider the errors in diagnosis which may occur, even on the part of the best diagnosticians. Unconsciously, we are very apt, after having accepted a theory, to entertain only such evidence as tends to strengthen our belief in that direction. How can we reasonably entertain a statement that yellow fever follows the exposure to some garment, or other material, when we have such indisputable evidence as I have presented to show that the disease is neither contracted by personal contagion or clothing, bedding, etc. The hospital reports of 1798 to 1805, to which I have referred, are invaluable, as at that time disinfection was not understood, and there is not the slightest evidence that any protection was afforded in this manner. Furthermore, I am unable to find any reliable or conclusive evidence to show that in the outbreaks of yellow fever, which from time to time have occurred in the South, disinfection has been of any value in abating the disease. In connection with this, I will call attention to the fact that, in the experiments made by Dr. Reed, non-immunes were placed in prolonged contact with the bedding, clothing, etc., of those sick with yellow fever without the slightest evidence of infection; and is it not significant that those living within the yellow fever zone have learned to look forward to the appearance of frost, which terminates the activity of the mosquito, as the only prompt and sure means of ridding a community of yellow fever?

If we accept a sanitary science, we must abide by its teachings, and I know of no better time than the present to look this matter fairly and squarely in the face, and make such changes in our sanitary regulations as are necessary to conform to our present knowledge of yellow fever. What I am now advocating I put into practical operation five years ago, at the port of New York, as, after a careful consideration of the subject, I was convinced that yellow fever is contracted neither by personal contagion, nor the clothing, bedding, etc., of those suffering with this disease. Since the above time, many vessels have arrived here with persons sick with yellow fever, and with the bodies of those who have died of the disease during the voyage, but in no instance have those on board been detained if five days had elapsed since the departure of the vessel from the infected port, although there may have been free exposure to the patient, his clothing, bedding, etc.; however, no secondary cases have ever occurred. It is true that, after the removal of the patient, disinfection is performed in compliance with the existing quarantine regulations, but this treatment on the arrival of the vessel can in no way affect those who had been in close contact with the patient while en route. I believe the value of Dr. Reed's experiments lies largely in

the fact that they indicate a line of procedure in the treatment of yellow fever which, if promptly and properly carried out, limits at once the extension of the disease. I refer to the use of netting, and other means, to guard against the mosquito. Commerce has patiently suffered the enforcement of regulations which, in the present light of our knowledge, are uncalled for, and it is but just that we should give this subject prompt consideration.

There are some details regarding the relation between the mosquito and yellow fever which are yet to be made clear; for instance, why do not infected mosquitoes reach vessels lying in Havana harbor, not far from the shore, or vessels which lie at the dock at Santos, and other infected ports, and at some subsequent time, or at different periods, transmit the disease to those on board, or at the point of destination? Yellow fever does sometimes occur among the crew of vessels docked at yellow fever ports, but this is easily explained by the fact that the crews are allowed to enter the town. In explanation of this it may be said that all who have studied the habits of the mosquito fully agree that it prefers to remain in the immediate vicinity of its breeding or abiding place; this is also borne out by the fact that we do not see secondary cases of yellow fever on shipboard, provided the vessel has left the infected port, and there is but little reliable evidence that infected mosquitoes are transmitted to foreign shores. It is not impossible for this to take place, and instances have been reported where secondary cases have occurred after leaving port. How many of these statements are authentic, I do not know, but of this I am sure, that it occurs only in rare instances, and we are surely not justified in making our rules conform to these possible exceptions. Suppose that it should be deemed necessary to take action against this possible danger, what can be done that is reasonable? We cannot assume that the mosquito is confined to any special part of the ship; it may be in the forecastle, saloon, engine room, or the hold of the vessel. Therefore, if we are consistent in carrying out such extreme measures, we cannot stop short of fumigating, or in some other manner treating every part of the ship. To those who are familiar with this work, I need say nothing; to those who have never undertaken it I say that such treatment is the most formidable and expensive that a quarantine officer is called upon to perform, besides the long delay to the vessel. Moreover, I do not believe that such action is justifiable unless there is satisfactory evidence that infected mosquitoes are on board, as would be indicated by the appearance of secondary cases of yellow fever after a departure of five days from an infected port.

Another question may here be presented for consideration, and it is this: Does five days represent the maximum period of incubation of

yellow fever, or may the disease develop after a longer period of time? I am aware that instances have been cited where the disease has ocurred after a period of incubation of six or seven days, or even longer, but none have come under my notice. I believe the early symptoms generally present themselves on the third or fourth day. There is no doubt that errors are often made in computing the period of incubation, as persons may be passing through the early stage without any well-marked evidence of it. This I have detected a number of times by the use of the clinical thermometer. A reference to the opinion of many careful investigators, among whom we find Dr. George M. Sternberg, will show that it is the general opinion that five days is the maximum period of incubation. I believe this is sensible and safe, and that regulations should be made accordingly, notwithstanding the fact that evidence has been presented which tends to show that it occasionally covers a longer period.

If we believe that yellow fever is not transmitted by personal contagion or clothing, bedding, etc., of those sick with this disease, and that the medium of infection is the mosquito, we must admit that disinfection offers but little protection. No other view is reasonable or logical. Our efforts, therefore, should be turned toward the detection of cases of yellow fever and their treatment according to our present knowledge of the disease. There is no doubt that many outbreaks of yellow fever have been caused by the presence of mild or unrecognized cases where the infection was attributed to clothing, etc. For this reason special effort should be made to detect this type of the disease, which can be done only by a careful and thorough inspection. Moreover, each community, particularly in the yellow fever belt, should be supplied with an apartment or hospital for the special care of yellow fever, where the most approved methods of protection against the mosquito are in operation. Furthermore, health officials should be familiar with the different variety of mosquitoes, and should, from time to time, make investigations to ascertain, if possible, the presence of the insects which transmit infectious material. I cannot agree with those who hold that a bad sanitary condition does not constitute an important factor in the propagation of either yellow fever or malaria. I am satisfied that it does, inasmuch as filth and bad drainage furnish the breeding places for the mosquito.

In accordance with the above views, the treatment of incoming vessels from ports infected with this disease becomes very simple: if they are five days or more in transit, and all on board are found to be well after a careful inspection and the use of the clinical thermometer, the vessel, its passengers, and crew shall be released without further detention or treatment. If the vessel has been less than five days in transit,

all on board who cannot present satisfactory evidence of immunity should be removed and held for observation until the completion of a period of five days from the time of departure from the infected port, and then released only after a careful inspection.

When yellow fever is found on incoming vessels, the procedure should differ only so far as it concerns the removal of the patient to a properly constructed hospital or apartment for treatment.

Dr. Reed's experiments have not conclusively shown that there may not be some other means than the mosquito by which yellow fever is transmitted. But when these experiments are considered in connection with the results of our practical experience it is clearly evident that this disease is not contracted by personal contagion or through the medium of clothing, bedding, cargoes of vessels, etc. Therefore, I believe we are justified in changing our quarantine regulations to conform to these views and that such a proceeding is safe and reasonable, particularly as we now have at hand a method which, if properly and scientifically carried out, can be depended upon to limit the extension of yellow fever. If the future shows that there are other means of infection it will then be time enough to add whatever restrictions are necessary for the protection of the public health.

I am convinced that in following this line of action we are not only offering full protection to the public, but are extending to commerce a relief from unnecessary and unreasonable regulations.

FOMITES AND YELLOW FEVER.

By A. N. BELL, M. D., Brooklyn, N. Y.

The purpose of this note is to invite attention to some personal observations and verified knowledge of the agency of fomites in the propagation of yellow fever, overlooked or ignored by expert bacteriologists in recent researches and reports.[1]

Assuming that every member of this Association is familiar with the substance of the investigation and reports here referred to, demonstrating the agency of a certain species of mosquito, as an intermediate host in the transmission of yellow fever, reference will be made to such portions of them only as appear to be in conflict with, or deficient in the recognition of, fomites as the hitherto accepted cause of many outbreaks of yellow fever, inexplicable by the alleged exclusive agency of mosquitoes.

I do not question the accuracy of the researches demonstrating the agency of the mosquito as an intermediate host and agent in the transmission of the infection, but I deny the sufficiency of this agency to account for the supersusceptibility to, and the retention of, yellow fever infection by unclean localities under climatic conditions favorable to the propagation of the disease; houses and ships in which yellow fever has prevailed and that have not been thereafter cleansed and aerated; certain kinds of ballast and merchandise, taken from infected localities, or infected vessels, or from localities where and when yellow fever prevails; personal clothing and books that have been long exposed in infected vessels or houses and packed therein without previous disinfection. Verifiable cases and even outbreaks of epidemics have occurred in connection with such conditions when no mosquitoes have been in evidence, nor any precursory *case of yellow fever*—necessary according to the showing of the experts—whose infected blood must be sucked and transmitted as a condition of the propagation of the disease.

Concisely summed up and endorsed by Dr. Sternberg:

"The inference drawn by Dr. Reed and his associates, from the experiments thus far made, was that yellow fever may be transmitted by

1 The Etiology of Yellow Fever. *Yellow Fever produced by the bite of Culex fasciatus.* By Major Walter Reed, Surgeon, U. S. Army; Dr. James Carroll, Contract Surgeon, U. S. A.; Dr. Agramonte, Contract Surgeon, U. S. A., and Dr. Jesse W. Lazear, Contract Surgeon, U. S. A. Read at the Pan-American Medical Congress, Havana, February, 1901. (Journal American Medical Association.) Sanitation and Yellow Fever in Havana. Report of Major V. Havard, Surgeon, U. S. Army, Chief Surgeon, Havana, February 8, 1901 (Sanitarian, July and August, 1901). The Transmission of Yellow Fever by Mosquitoes. By George M. Sternberg, Surgeon-General, U. S. Army (The Popular Science Monthly, July, 1901.) The Propagation of Yellow Fever; Observations Based on Recent Researches. By Walter Reed, M. D., Surgeon, U. S. Army (Medical Record, August 10, 1901).

mosquitoes of the genus *Culex*, but that in order to convey the infection to a non-immune individual the insect must be kept for twelve days or longer after it has filled itself with blood from a yellow fever patient in the earlier stages of the disease. In other words, that a certain period of incubation is required in the body of the insect before the germ reaches its salivary glands, and consequently before it is able to inoculate an individual with the germs of yellow fever. This inference, based upon experimental data, received support from other observations, and which have been repeatedly made with reference to the introduction and spread of yellow fever in localities favorable to its propagation. When a case is imported to one of our Southern seaport cities, from Havana, Veracruz or some other endemic focus of the disease, an interval of two weeks or more occurs before secondary cases are developed as a result of such importation. In the light of our present knowledge this is readily understood. A certain number of mosquitoes having filled themselves with blood from this first case, after an interval of twelve days or more bite non-immune individuals living in the vicinity, and these individuals, after a brief period of incubation, fall sick with the disease; being bitten by other mosquitoes they serve to transmit the disease through the 'intermediate host' to still others. Thus the epidemic extends, at first slowly, as from house to house, then more rapidly, as by geometrical progress."

But whence and how the first case, whose blood is necessary for the mosquito before it can become intermediary—how did he become infected? True, part of the title of the Army Board report is, "Yellow Fever *Produced* by the Bite of *Culex Fasciatus*." But evidence is wanting to show it. It is transmitted, but *not* produced.

Nevertheless, the board concludes:

"Yellow fever is not conveyed by fomites, and hence disinfection of articles of clothing, bedding or merchandise, supposedly contaminated by contact with those sick with this disease, is unnecessary.

"A house may be said to be infected with yellow fever only when there are present within its walls contaminated mosquitoes capable of carrying the parasites of the disease."

And to these conclusions, Major Havard adds:

"Disinfection becomes completely useless, since there are no infectious germs to destroy. In a house where a case of yellow fever has been under treatment, the problem is how to reach the mosquitoes which have become infected by biting the patient and are still lurking in the vicinity. * * * Since we may assume in practice that the infectious germs do not exist outside of a man or mosquito, the disinfection of trunks and baggage on account of yellow fever is no longer justifiable; all that is required will be the examination of non-immunes within the five days

immediately following their last exposure to infection, the danger of transmission being from their own persons and in no wise from their clothing or baggage. Ships, like houses, are liable to harbor infected mosquitoes and will continue to require fumigation."

Moreover, he refers to the non-contagiousness of the disease as a "*discovery* by Major Reed and his associates, conclusively proved by direct experiment that recently soiled linen, bedding and effects of all kinds are powerless to convey the disease. This discovery," he says, "must bring about a revolution in our methods of disinfection and quarantine in yellow fever."

This knowledge of the non-contagiousness of yellow fever has been acted upon for more than half of the past century by physicians of actual experience in connection with yellow fever everywhere. The "direct experiment" of collecting a quantity of recently soiled linen and bedding by yellow fever patients and sleeping in them, was but a feeble imitation of what one of the surgeons of the French frigate *Gomer* did in the naval hospital at Pensacola in 1838. For besides the bed and clothing in which he slept, and from which the dead body of a yellow fever patient had just been taken, the ward was full of cases of yellow fever. This he did in order to show the comrades of the sick, required to nurse them, that there was no danger in their so doing. The incident was described to me by the late Dr. Isaac Hulse, U. S. Navy, who was surgeon of the hospital at the time. My own personal experience with yellow fever at the outset was scarcely less explicit, besides its subsequent relation to fomites—an infected ship.

Fifty-four years ago, being an assistant surgeon in the Navy, during the war with Mexico, I was ordered to a hospital on Salmadina Island, in the vicinity of Veracruz, constructed of rough pine boards, where, in a "ward" about twenty feet square, I had for room-mates for a period of six weeks from two to six patients with yellow fever. We took our meals in the same room. In an adjoining room, about thrice as large, with an open doorway communicating, without a door, I had under my care for the same length of time from ten to forty cases—there was a daily increase in the number; and, during the last two weeks of the period, about forty more in a tent twenty feet distant, who were cared for during the day time by two visiting surgeons attached to vessels anchored near by. My health was excellent during the period, but at the end of it I was transferred to the infected frigate *Mississippi,* on board which ship most of the cases orginated, in charge of as many of the sick as, in my judgment, could be safely taken on board—there were 127—under orders to proceed to Pensacola and transfer them to the naval hospital at that place.

My fourth night on board the *Mississippi* was a restless one, with symptoms of yellow fever. Within the forty-eight hours before and subsequent to my attack twelve other new cases had developed—all of them of new-comers to the ship, some from the hospital attendants, and the others transferred from vessels of the squadron.

There were mosquitoes in the hospital during the whole period of my service there; they were also present in all the vessels of the squadron. But, admitting their agency in the transmission of the disease, the *Culex* seems to have been almost exclusively confined to the *Mississippi,* where most of the cases occurred.

In the afternoon of the day following my attack in the night, the ship having arrived at Pensacola, all the sick, myself included, were transferred to the naval hospital. Six weeks thereafter I returned to duty on board the same ship, she having been meanwhile "broken out" and limed. If mosquitoes were still present they were not in such evidence as to attract attention. Three weeks later, October 17th, she again put to sea for Veracruz. On the fourth day out a case of yellow fever occurred on board, in a non-immune received on the day of her departure from Pensacola. She arrived at Veracruz October 22d, at the beginning of the first norther of the season—ever welcome as frost in New Orleans as an estop to yellow fever. Up to this time the fever had been increasingly prevalent in the city and squadron. The norther continued about a week with comfortably cool but rainy weather. Almost immediately following there was notable abatement of the fever on shore and in the squadron generally. But not so on board the *Mississippi* to non-immune new-comers; one rarely escaped an attack within five days. And so she continued to the end of her service in the Gulf, went North, and was subjected to a freezing temperature; explicable, perhaps, by the possible continued presence of *Culex fasciatus.*

But hardly so in the case of the U. S. Frigate *Susquehanna.* This ship, after more than two years' service in the Mediterranean, October, 1857, was ordered from Spezzia to San Juan de Nicaragua, where she arrived early in December; having touched by the way at Genoa, Madeira and Key West. She remained at San Juan until the first of the following April, having had during the whole period of time she lay there a constantly increasing sick list of a "precursory" fever. At first intermittent, then remittent, but all recovered until March 20th, when a case became malignant with symptoms of yellow fever, and died; other cases followed. The ship put to sea April 1st, and on the 5th arrived at Port Royal, Jamaica, with one hundred and six officers and men down with yellow fever.

Most of these were sent to the hospital, and on the third day afterward she sailed for New York, where she arrived April 15th, with fifty-one cases on the sick list.

The remarkable feature in this instance is, that at San Juan, where the yellow fever first appeared on board the *Susquehanna*, there was no yellow fever, and the disease had never been known to occur there. As before stated, she had been more than two years in service on the Mediterranean, but with no extraordinary sickness on board. She had had yellow fever on board during service in the Gulf Squadron the summer before she was ordered to the Mediterranean, nearly three years before, and was supposed to have been thoroughly cleansed before she was ordered to the Mediterranean station. But, as the sequel shows, she still retained the germs of the disease (or mosquitoes?) until she returned to the conditions of the yellow fever habitat at the Port of San Juan.

It is conceivable that the advocates of the exclusive instrumentality of the mosquito in her case may contend that she might have shipped the *Culex* when she touched at Key West. But there was no yellow fever there at the time, and no case intervened between that time and the first unequivocal case on board the *Susquehanna*, March 20th, after several weeks' prevalence of a *precursory* fever—a not very unusual feature of yellow fever observed on other occasions; and prominently so at the first outbreak of the disease in Rio and Callao.

In 1849-52 the harbor of Rio was more or less crowded with vessels from American ports, most of them destined for the Pacific, on account of the California "gold fever." How many of them infected with yellow fever, contracted while in service as storeships or otherwise in the Gulf during the Mexican War, two or three years previous, when yellow fever was exceptionally prevalent there, arrived at Rio or touched at other Brazilian ports where yellow fever for the first time appeared is problematical, but that some were is beyond question. My interest in the subject on the first occurrence of yellow fever in Callao led me to make some inquiry.

I ascertained that about the middle of the year 1851 the steamer *New World*, after having lost more than half her crew by yellow fever in Rio, on her way to California, touched at Callao. The steamer *Pinto* also, during the same season, lost several of her crew there, proceeding to the Pacific and arriving at Callao in April, 1852. Soon after her arrival a mild form of a peculiar fever broke out in Callao and Lima, which the natives called "pelusa," similar to the precursory fever which prevailed in Rio in 1849; it was called "polka." In both instances the disease speedily developed yellow fever. And considering the voyages, so inconsistent with the continued presence of

mosquitoes on board ship, it is hardly conceivable that they had anything to do with either its introduction or transmission.

The persistence of yellow fever-infection under conditions commonly fatal to mosquitoes is particularly well shown in the history of the U. S. Steamer *Plymouth*. She first became infected at St. Thomas in the summer of 1878. In November following she was sent to Portsmouth, N. H., and about a month afterward to Boston, where she remained four months. Meanwhile everything was removed from the ship; the crew were transferred, and she was fully exposed to intense cold for a month—for ten days of that time in dry-dock, with a temperature at times below zero. The water in the tanks was frozen, as it was in basins put in the store rooms of the ship, and for several days after the fires were rekindled on board the cold continued so intense that the water froze in the bilges at night. One hundred pounds of sulphur was burned below decks, the fumigation extending over two days; the berth deck, holds and store-rooms were thoroughly whitewashed with a mixture of lime and chloride of lime. March 15, 1879, she left Boston for a cruise in the West Indies. On the night of the 19th, in a severe gale of wind, the hatches had to be battened down and the berth deck became very damp and stuffy. On the morning of the 22d (she had not touched at any port) Richard Saunders, machinist, was sick, but did not report until afternoon, when he had violent headache and fever. During the night of the 22d, Peter Eagan, boatswain's mate, was taken suddenly and violently sick with the same symptoms. On the 23d, at sea, latitude N. 27.48, longitude W. 57.59, the surgeon (Woolverton) reported both cases yellow fever, and recommended that the ship proceed no further on that cruise. The first case recovered; the second died on the third day of illness. The ship's course was changed to northward, and she arrived at Portsmouth, N. H., April 7th. No new cases appeared after she turned.

"I am convinced," said the surgeon, in his report, "that the fever infection is confined to the hull of the ship, and especially to the unsound wood about the berth deck; and that while the *Plymouth* is a safe and healthy ship in a temperate climate, she cannot, for the present, be sent into a tropical climate without the certainty of an outbreak of yellow fever occurring on board; and that no precautionary measures whatever could avail to avert such a result."

Soon after her return to Portsmouth, April 17th, she was surveyed by a board of medical officers, who reported that:

"After careful consideration of all the facts, we have arrived at the conclusion that the infecting virus which gave rise to the last out-

break of fever must have been preserved in the rotten wood of the berth deck, or in the bedding or clothing of the crew."

Of Ballast.—July 12-18, 1878, yellow fever broke out on board the U. S. ship *Vermont*, at the Brooklyn Navy Yard, of which there were eight cases, with three deaths. According to the investigation and report of a board of medical officers of the Navy, "the disease seems to have originated from the ballast of the bark *Juanita Clar*, which left Havana May 1st. This ballast, quarry clippings and sand was deposited on the dock on either side of the *Vermont*, and about one hundred yards distant from her." On this report the ballast was promptly disinfected and covered over with fresh earth, after which there was not another case.

Of Personal Effects.—During my service as medical superintendent of the floating hospital in the Lower Bay of New York, in September, 1862, I was sent for by one of my colleagues of the Brooklyn hospital for consultation in a suspected case. I there found an unequivocal case of yellow fever, who died the third day thereafter. She was the widow of a seaman who had died in New Orleans two or three months before, whose clothing she had received and washed four days before she was taken sick.—Incidentally, it may here be remarked, this was when General Butler was in command at New Orleans, when, it has been frequently alleged, there was no yellow fever at that place. On the contrary, though there was no commerce with Havana or other yellow fever ports during General Butler's administration in New Orleans, "there were two reported deaths by yellow fever in the civil population, and about one hundred cases in the river fleet."—Prof. Stanford L. Chaillé, M. D. (*Sanitarian*, August number, 1882).

Not long after the case in Brooklyn, I met and had occasion to relate it to the late Dr. William Johnson, Surgeon U. S. Navy. He expressed no surprise, but related a still more strongly illustrative case of himself.

On the termination of a cruise on the west coast of Africa, some years before, when yellow fever occurred on board the ship to which he was attached, he packed his books in a barrel and so left them for about three months after they had been received and his arrival home. He then proceeded to unpack them, and three or four days thereafter he was taken with yellow fever and came near dying.

I have no need to be told that this recital is an epitome of ancient history. It would be easy to extend it and quote reports of outbreaks in the Gulf States in recent years, with which contemporary observers are familiar; but I do not deem it necessary. Such occurrences have been the foundation of our most intelligent quarantine practice, both

State and National, during recent years, and with such results as, in my judgment, justify their continuance.

Moreover, with regard to the relation of unclean localities, as well as foul ships, I think the remarks of John Simon, in his report to the commissioners of sewers of London, in 1854, with reference to cholera, are even more pertinent to yellow fever, and no less suitable today than they were fifty years ago:

"The specific migrating power, whatever its nature, has the faculty of infecting districts in a manner detrimental to life *only when their atmosphere is fraught with certain products susceptible, under its influence, of undergoing poisonous transformation.* * * * Through the unpolluted atmosphere of cleanly districts it migrates silently, without a blow; that which it can kindle into poison lies not there. To the foul, damp breath of low-lying cities it comes like a spark to powder. Here is contained that which it can quickly make destructive—soaked into soil, stagnant in water, griming the pavement, tainting the air—the slow rottenness of unremoved excrement to which the first contact of this foreign ferment brings the occasion to changing into new and more deadly combinations."

TENTH REPORT ON YELLOW FEVER IN MEXICO.

By Dr. EDUARDO LICEAGA,

President of the Supreme Board of Health of Mexico.

This is a report of all cases of yellow fever which have been observed on the two coasts of the Mexican Republic from the 17th of September, 1900, to the 31st of August, 1901.

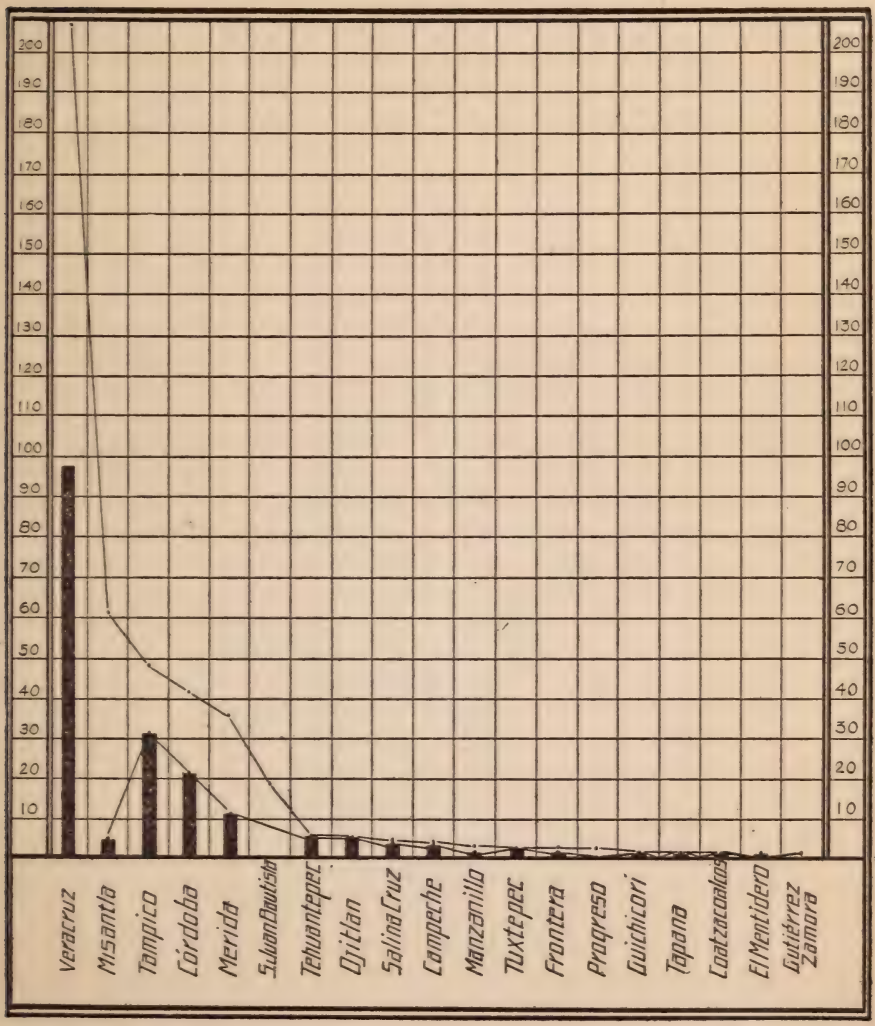
The sanitary authorities of Mexico have imposed on themselves the obligation of never attempting to hide the diseases that prevail in its ports and frontier towns, and privately, I have assumed the obligation to appear and declare every year, before this important Association, the cases of yellow fever that have been observed within the territory of the Mexican Republic and reported to the Supreme Board of Health.

During the period that has elapsed from the 17th of September of last year to the 31st of August of this year, cases of yellow fever were observed in Veracruz, distributed as follows:

40	cases	in the period	from the 17th to the 30th of September.
63	in	the month	of October.
33	"	"	November.
22	"	"	December.
8	"	"	January, 1901.
5	"	"	February.
0	"	"	March.
3	"	"	April.
1	"	"	May.
8	"	"	June.
13	"	"	July.
13	"	"	August.
209			

The number of cases reached a maximum in October of the previous year, declined in the following months of November and December, rapidly decreased in the months of January and February of this year and disappeared in March. As can be seen, Veracruz shows the majority of the cases that have been observed in the Mexican Republic, and the highest figure for any one month was sixty-three in October of last year. We can safely say, that in the present year we have had no real epidemic.

DIAGRAM SHOWING THE NUMBER OF CASES AND DEATHS FROM YELLOW FEVER IN THE CITIES AND PORTS OF THE MEXICAN REPUBLIC, FROM THE 17TH OF SEPTEMBER, 1900, TO THE 30TH OF AUGUST, 1901.



As regards the number of cases, the Port of Tampico comes next, with forty-eight cases reported. In Cordova there were forty-three, in Merida 36, in San Juan Bautista 19, in Tehuantepec 6, in Ojitlan and Salina Cruz 5 each, in Campeche 4, in Manzanillo 4, in Tuxtepec, Progreso and Frontera 3, in Huichicori 2, and in Tapana, Coatzacoalcos, Mentidero and Guiterrez Zamora 1 each.

With the above figures two diagrams have been prepared, of which one shows, in red lines, the number of cases reported, and in black lines the number of deaths in the towns of the different States. In the other diagram, the same colors show the number of cases reported and the deaths; but they have been placed in a progressively decreasing order, and without taking any notice of the State to which the towns referred to belong.

These diagrams also show that the cases of yellow fever are unequally distributed in the Gulf and Pacific Coasts, and that on the latter there were two foci: one in the south of the State of Oaxaca, with seven cases, and the other entirely isolated in the Port of Manzanillo, where only four cases were observed.

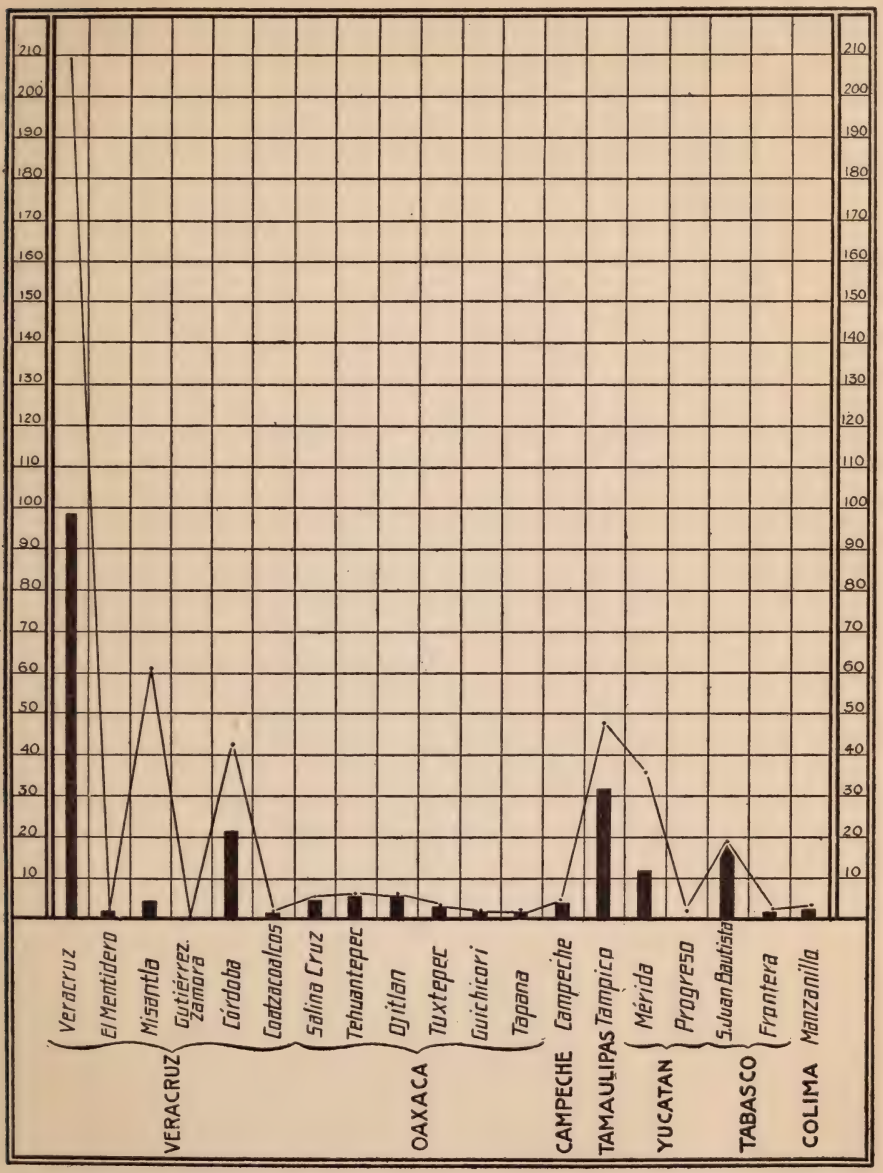
We, therefore, find that during the period elapsed from the 17th of September of last year to the 31st of August of this, there has been no important epidemic of yellow fever in the Mexican Republic, except in the Port of Veracruz.

The sanitation works already commenced in the Port of Veracruz; the abundant supply of pure drinking water and the sewering of the Port, will undoubtedly give as good results in that Port as they have already given in Havana. Similar works in the Port of Tampico will improve its sanitary condition, and we may reasonably hope that the endemic of yellow fever will disappear from both of these places.

The recommendations which have been published in all those places where this disease reigns in an endemic or sporadic manner, that the residents should protect themselves against the bites of the mosquito *Culex fasciatus* as well as prevent those that have bitten yellow fever patients from escaping out of the wards in which those patients are attended, to go and infect non-immunes outside of the hospital, will assure, as they do in Havana, the disappearance of the endemia from the coasts of the Republic.

On the other hand, the enforcement of the maritime sanitary regulations has continued giving the same good results as in previous years, and not a single case has been reported of communication by sea. It is to be hoped that the adoption of these measures of public hygiene and the constant publication of the rules of private hygiene, will bring about the disappearance of yellow fever from our country.

DIAGRAM SHOWING THE NUMBER OF CASES AND DEATHS FROM YELLOW FEVER IN THE CITIES AND PORTS OF THE MEXICAN REPUBLIC, FROM THE 17TH OF SEPTEMBER, 1900, TO THE 30TH OF AUGUST, 1901..



I cannot bring this paper to a close without announcing that the sanitary measures which were adopted in Orizaba and reported by me in the last meeting of this Association, were so efficacious that not a single case of yellow fever has been since reported in that locality.

A BRIEF STATEMENT OF THE SANITARY WORK SO FAR ACCOMPLISHED IN THE PHILIPPINE ISLANDS, AND OF THE PRESENT SHAPE OF THEIR SANITARY ADMINISTRATION.

By CHARLES R. GREENLEAF, Colonel, Assistant Surgeon General U. S. Army, Late Chief Surgeon, Division of the Philippines.

In presenting to you a statement outlining sanitary conditions in the Philippine Archipelago, it should be borne in mind that the methods adopted since the American occupancy have been tentative in character and designed mainly with a view to the preservation of the health of the troops, and as the city of Manila was for a considerable length of time the only place occupied by troops, the regulations then issued applied only to that city. As other parts of the country came into our possession the scope of work was enlarged and general regulations governing the whole Archipelago, with special instructions for municipalities were issued. Even in this extension of work, nothing of a permanent nature was attempted, since it was known that the civil authorities would sooner or later assume control and establish a permanent system and a definite code for the sanitation of the Islands.

The condition of Manila at the time of our occupancy was about the same as that of other Spanish cities—Cuba and Porto Rico—which came under our control. But little attention had been given to sanitation from the outbreak of the insurrection of the Filipinos against the Spaniards, until after the surrender of Manila to the Americans; the state of affairs can therefore be better imagined than described. Immediately following the surrender, the general commanding gave orders for the establishment of a board of health in connection with the Provost Marshal General's Bureau, and medical officers were detailed for its organization. Work was promptly commenced, by the employment of a sanitary force to clean the streets, alleys and public parks, remove garbage and excreta, cleanse the prisons and other public buildings, and to put the city in as good order as possible. A hospital for contagious diseases was established, and as smallpox was endemic in the city, a system of compulsory vaccination was instituted. Fortunately the water supply of the city was ample, and although its quality was not above suspicion, the measures taken to sterilize it for drinking purposes left but little cause for apprehension.

Early in 1900, the troops having advanced into the Provinces, and the city being somewhat relieved of its overcrowding, the details of the

original plans were amplified, additional inspectors appointed and municipal ordinances passed to insure the proper execution of their work. To enforce the regulations for the sanitation of houses, legal procedures against the owners were authorized and they who, after due notice failed to rectify reported defects, were mulcted in the cost, the work being performed under direction of the Board of Health.

It then became necessary to consider the health of the pueblos and barrios which the troops occupied in the Provinces, and for this purpose the functions of a Superior Board of Health for the Archipelago devolved upon me as Chief Surgeon of the Division. I accordingly recommended to General MacArthur, the Military Governor, that the commanding officers of the troops occupying these places should be instructed to use every effort to put them in proper order and to require the medical officer serving with the command to act as health officer, following a line of general instructions based on the methods followed in Manila, special orders being given for the vaccination of the population of the towns and neighboring barrios as far as the people could be reached. Funds were provided for the purchase of medicines to be used with the indigent sick, and the Presidentes were enjoined to make provision for their hospital accommodation when necessary.

At seaports, the local medical officer in addition to his military duty, served as quarantine officer, and followed the methods of inspection and quarantine laid down by the Marine Hospital Service. About this time, attention was drawn to the large number of lepers who had been turned loose throughout the country by the closing of the institutions in which they had been sheltered; reports from the Provinces indicating that about 30,000 of these unfortunates were to be found in the Islands, for whose care there were but two organized hospitals, one in Manila and one in Cebu. As their presence was a menace to the public health and the necessity for their early segregation was obvious, it was deemed best to recommend it by colonization, after the manner of the leper settlement in the Sandwich Islands.

General MacArthur took great interest in the preparation of these administrative measures, and by his prompt and vigorous action their success was assured.

The most crying need in the early days of our occupancy of the Provinces was to check the ravages of smallpox. Virus for vaccination was scarce, and as it was brought from the United States much of it had become inert. The vaccine farm that had been organized in Manila, for propagating lymph from caribao calves, was utilized and in a short time an abundant supply of fresh virus was obtained and issued as called for by medical officers. Native vaccinators were em-

ployed, and when a large population was to be protected, men skilled in performing the operation were sent from Manila. These made house to house inspections and vaccinated all who were not immune from smallpox. This work was by no means devoid of danger, and several instances occurred where the vaccinators were captured by insurrectos or kidnapped by the inhabitants and killed. In many places distant from the vaccine farm the work was much hampered by the rapid deterioration of the virus by the heat, but as ice machines were installed in various parts of the country this difficulty was measurably overcome by depositing the stock in cold storage and drawing upon it as wanted. The success of the Manila vaccine farm was so pronounced that similar farms were established in other parts of the Archipelago, and soon obtained like results. Over a million units of virus were issued from the Manila farm during the past year. The effect of this wholesale vaccination was quickly apparent in the disappearance of smallpox from many localities where it had previously committed great ravages, and by a falling off of about 80 per cent. in the number of cases among the troops. In all cases where the disease continued, it was found that the work of vaccination had been carelessly done or had been in some way intefered with. The effect among the school children was very marked, and reports of cases occurring among them, that before had been of almost daily occurrence, are now very rare.

To facilitate the work of the Board of Health, a pathological laboratory had been established in a modest way, to which additions were made from time to time, and it is now thoroughly equipped, and under the direction of Dr. Calvert has produced excellent work, notably in bubonic plague. A chemical laboratory has also been added and an efficient chemist placed in charge for the purpose of analyzing food supplies, liquors, etc. On behalf of the Army I established and equipped a pathological laboratory in Manila and placed Lieutenant Strong in charge. His work is doubtless well known to you and his contributions to the pathology of tropical diseases, especially intestinal parasites and dysenteries and diarrhœas, has been of inestimable value. I also instituted a special study of the water supply for Manila, which included water furnished from the several distilling plants that had been installed for the use of the troops. At an early date the Board of Health instituted measures to secure a registration of marriages, deaths and births and established a division of vital statistics, the record of which will appear in its forthcoming report for the past year. Examining boards were organized to determine the professional fitness of physicians, dentists and pharmacists, and midwives were required to furnish evidence of their fitness to pursue their calling.

All the people of these professions were required to procure licenses to practice. The examining and renovation of cemeteries was also made a special work and the numerous defects in the old systems were corrected.

An idea of the work performed by the Board of Health during the past year can be best given in the following brief outline of its forthcoming report:

"The important work of taking a census of the inhabitants of Manila was begun January 1st and ended in April.

The total population of the city, exclusive of officers and men of the Army and Navy, was found to be 244,732, divided as follows:

American	8,461
Filipinos	181,361
Chinese	51,567
Spaniards	2,382
Other nationalities	961
Total	244,732

For the purpose of sanitary inspection the city is divided into ten districts. The member of the Board in charge of this bureau has a force of one interpreter, one chief inspector, ten district inspectors, and sixty inspectors; ten are Chinese and the rest are Filipinos. Irrespective of special work in epidemics these men are required to make a weekly inspection of every house in the city, and report daily on the conditions found. They search for contagious diseases, distribute rat poison, and disinfect when necessary. They have made in the period of ten months 114,032 inspections of premises, disinfected 722 houses and cleaned 864 premises. A sanitary card is posted in each house, on which is noted the condition found by the inspector, with date of visit. The work done by the inspectors is thus checked by the chief and district inspectors.

The people evince a most gratifying willingness to accept the sanitary instructions of the Board of Health and the sanitary condition of the city is excellent, as far as the inhabitants can make it so, and the many unhygienic conditions remaining can only be remedied by the municipality, and by the expenditure of much money.

Improvements most urgently needed are: (1) A system of drains and sewers. (2) Dredging and cleaning moats and canals. (3) A water supply, pure and ample.

Licenses involving physicians, pharmacists and dentists, the sale of food and drink, offensive trades and lodging houses, are referred to the Board of Health, and no license is granted or renewed unless approved by the Board of Health. Tenements and lodging houses are apt to be overcrowded under present conditions, but a limit is to be

established, and lodging-house licenses will be issued for a maximum number, and inspections made to see that the law is complied with.

The Board of Health has had to contend with the following infectious or contagious diseases: Bubonic plague, smallpox, tetanus, typhoid fever, tuberculosis, whooping cough, measles, mumps, and beri beri.

Compulsory notification is required of each case of the above diseases, except beri beri and tuberculosis.

Cholera has fortunately not gained an entrance, though present at Singapore and on shipboard at Hong Kong.

Bubonic plague exists in Manila and is dealt with in the most stringent manner; 254 cases, with 199 deaths, have occurred.

Last year the disease reached its maximum in March; this year in April. Experience shows that the disease increases with the hot weather, reaches its maximum before the maximum temperature is reached, and declines with the rainy season to almost nothing.

The following method of dealing with the plague is in use: Medical officers, usually acting assistant surgeons awaiting transportation to the United States and temporarily reporting to the Board for duty, are stationed in the infected districts, each having an office with telephonic connection with the Board office. Every case of illness and every death in the district is reported to them, and they visit every case and inspect the dead. When necessary they send the patient or body to the General Plague Hospital or the Chinese Plague Hospital in ambulance used for this purpose, and summon a disinfecting cart at the same time. An inspector accompanies each patient or corpse to its destination. Another takes charge of the house until the disinfecting cart arrives. The floors are wet down with 5 per cent. carbolic acid; all clothing and articles which have been in contact with the infected person, and everything not easily disinfected, are burned in the street; other articles are sent to the steam disinfector. The house is systematically treated with the carbolic solution, which is thrown into all crevices by a force pump. All occupants of the house take a disinfectant bath, and exposed persons are sent to the detention pavilions. The house owner is compelled to make such alterations and repairs as may be needed, and the house is placarded and visited daily until twelve days have passed. The disinfecting carts are specially constructed and have a metal-lined compartment for articles to be sterilized, besides room for apparatus, etc. Bodies are removed in metallic caskets, to be burned or buried in quicklime; inspectors are on duty day and night.

Experience shows infected districts to be about the same as last year. A system of depopulation is being actively carried on; infected

houses and unsanitary hovels in their neighborhood are attacked and cubicles and partitions are removed, outhouses and structures built in yards and unfit for human habitation are destroyed, letting in sun and air; sewers and drains are flushed by the fire department, under supervision of the Board; all evicted people are given shelter in tents until they can find dwelling places.

These measures will have to be carried on unremittingly, but the very extensive municipal sanitary improvements already mentioned must be accomplished before Manila can be considered a healthy city.

Every precaution is taken to prevent the spread of plague from Manila to the Provinces. All passengers leaving by ferries and interisland boats are inspected in conjunction with the Marine Hospital Service, and a medical officer inspects all passengers leaving by train.

Rinderpest, which is prevalent among the cattle of the Philippines and bears directly, of course, on the public health, by affecting the meat and milk supply, is being studied here also; an immunizing serum is being tried and results are promising.

About the time that the governmental control of the Islands was transferred to the Civil Commission, that body by legislative enactment created a Department of Public Health, to consist of a Commissioner, a Superintendent of Inspection, a Sanitary Engineer, a Superintendent of Government Laboratory, and a Secretary. These officers, in addition to the specific duties assigned them, act as a Superior Board of Health for the Philippine Islands. The Chief Surgeon of the Military Division, Chief Officer, Marine Hospital Service, and the Dean of the Association of Physicians and Pharmacists of the Philippine Islands are made honorary members, but not entitled to a vote. There was also created a Department of Government Laboratories, of which the Superintendent above referred to is made the head. The Commissioner of Public Health is the chief executive officer of the bureau and has general supervision and control of its branches, of hospital for contagious and infectious diseases, and of the measures necessary for combating epidemic diseases.

The Superintendent of Inspection has supervision and control over municipal sanitation, and the Sanitary Engineer considers and reports on mechanical sanitary apparatus and plans for sewers, drainage and water systems.

The Superior Board of Health, which also serves as a local Board of Health for the city of Manila, is charged with the general supervision over all the interests of the public health in the Philippines and the study of their vital statistics. It is also to investigate into the causes, pathology and means of preventing diseases, including those of public animals; to disseminate useful information regarding them among the

people; to draft and recommend to the central legislative body suitable sanitary laws and laws governing the admittance of persons to the practice of medicine and its correlated specialties; for the control of offensive and dangerous industries or occupations and to prepare and recommend suitable provisions for the extension of the service of the bureau into the departments, Provinces and municipalities. It is given power to require reports and information from all public institutions, to order the abatement of nuisances, to enforce interior quarantine, and to decide on suitable location for the necessary laboratories for the production of vaccine virus, serums and prophylactics, and to distribute these products for use under its direction. The Superintendent of Government Laboratories has general charge of the construction and equipment of all government laboratories in the Islands and the purchase of apparatus and supplies for them, and may be the director of any one of them. He is to establish a biological laboratory for the investigation into causes, etc., of diseases of man and domestic animals or of animals utilized for food, and the methods of combating them; also a chemical laboratory for investigation as to the purity of foods and drinks, the properties of medicinal plants and herbs native to the Philippines, and such other chemical work as may be required by the Board of Health; and also laboratories for the production of vaccine virus serums and prophylactics necessary for the safeguarding of the public health.

It will thus be seen that the Philippine Islands are provided with a systematic sanitary organization and a well-considered sanitary code.

The most important subjects with which the Superior Board has now to deal are: (1) The establishment of a thorough system for the vaccination and revaccination of the non-immune population of the Islands, and the disinfection of infected buildings and clothing. Smallpox has been so common a disease that the people have ceased to fear it; with them it is a children's disease, since they are practically the only susceptible persons, the adult population being as a rule immune and representing the "survival of the fittest"; but foreigners will continue to become infected until the sources of the disease are eradicated. (2) The establishment of methods for the disposal of the excreta, in order that the purity of the water supply may be assured. Diseases of the intestinal tract claim the largest number of victims, both among natives and foreigners, and show the highest death-rate of any other class; and as the organisms which propagate them are invariably water-borne, the necessity for preventing their access to this supply is self-evident. It is safe to say that there is scarcely an unpolluted water course in the Islands, except high in the mountains, and in uninhabited regions. At present safety can only be assured by sterilizing

all drinking water, and in communities where this is understood water is boiled, or distilling plants are installed. (3) To check the progress of and to eradicate, if possible, beri beri, which is very prevalent among the natives. (4) To attempt the destruction of the mosquito larvæ and check the progress of malaria. This subject has been carefully considered, and in certain places successfully dealt with, but the vast extent of country under rice cultivation, where the use of petroleum is impracticable, makes it doubtful if its general application is feasible. (5) To control the progress of venereal disease. The influx of a foreign population, Asiatic, European and American, has made large increase in this class of disease, which is spreading from the seaports as centres, outward into the Provinces, and in time a large number of native women will be affected, and with less prospect of cure than their sisters in the cities; the native women outside of the cities, are, as a rule, free from disease, but it is they, without opportunity, knowledge or means sufficient to obtain treatment, who will when infected, become the greatest sufferers and the greatest menace to the public health. The segregation of this class of women to a certain portion of the towns, a supervision of their health, and a duly recorded treatment of the diseased should be systematially carried out, lest an irreparable injury be done to the people of these Islands by those whose object it is to help and elevate them. This subject must be looked at squarely in the face, and dealt with as any other contagious disease.

Finally, I can fully endorse the statement made in the last report of the Philippine Commission, "That no tropical islands in the world enjoy a better climate than do the Philippines"; but that certain "classes of diseases have to be reckoned with here." As to the diseases, if proper laws are enacted and enforced to govern the public health, the intelligent foreign visitor or resident may enjoy almost perfect immunity from sickness, provided he will only take care of himself. The native, however, does not know how to take care of himself; not only is he ignorant of the first principles which govern the preservation of health, but he has never had anybody sufficiently interested in him to instruct him in these principles. It has been a part of our duty to so instruct him.

When we reflect that some of the diseases found among these people are virulent in the nature of their infection, and in other tropical countries quickly develop into epidemics which are attended with frightful mortality, and that these people have been living under conditions of hardship and suffering that form ideal causation factors in producing epidemics, it is a subject for profound congratulation that, although frequently threatened, the advance of disease has been controlled and no epidemic has occurred, and moreover that the amount of sickness

and mortality has never exceeded what would naturally be looked for under the circumstances. Among the foreign population, which has numbered more than 100,000 souls, including the Army and Navy, the average monthly rate of sickness during the past eighteen months has not exceeded 8 per cent., and has been as low as 5 per cent., a rate not obtained in the tropical possessions of any other nation.

I have no hesitancy in saying that these remarkable results are mainly due to the faithful and conscientious manner in which the officers and enlisted men of the Medical Department performed their self-imposed sanitary duty, and to the intelligent co-operation that was accorded them by the officers of the line, with whom they served. This object lesson in one of the most important characteristics of the American people, humanity in war—has made a deep impression on the Filipinos, and has been an important factor in winning their allegiance to our Government. It is a privilege to do honor to the men who have followed so faithfully the Golden Rule, and who have served their country so well.

SANITATION IN PORTO RICO.

By WILLIAM F. SMITH, M. D.,

Secretary and Treasurer of the Superior Board of Health of Porto Rico.

Let me commence by giving a few of the leading physical features of Porto Rico, a knowledge of these being essential to the proper understanding of the subject in hand. Rectangular in outline, Porto Rico has an area of 3600 square miles, being about three-fourths the size of Connecticut, or about three times the size of Long Island.

But, small as it is, Porto Rico offers a great variety of soil and climate, and to speak of the climate in general terms is apt to lead to misunderstanding. The island consists of a mass of hills, the highest rising to about 3500 feet, and this elevated region is bordered on all sides by a belt of low alluvial land which is almost exclusively devoted to sugar and grazing. As a consequence of this arrangement the climates of these two regions are widely different. In the alluvial belt which is at the most a few miles in width, we have an equable temperature averaging for the year 80°. This heat is greatly tempered by the trade wind which is in almost constant operation, the direction being nearly N. E. In the interior the mean temperature varies with every little difference of elevation, and the amount of humidity depends largely on the position and direction of the hill ranges. It is a common experience for one district to be parched with drought, its neighbor a few miles distant being in a half-drowned state. Last week (August 12th), the extremes of temperature noted were 91° at San Juan and 58° at Aibonito, the difference being entirely due to an elevation of about 2000 feet. The rainfall at San Juan averages about sixty inches, being the same as at New Orleans, but on the northeast of the island it exceeds one hundred inches. The annual relative humidity at San Juan is almost 80 per cent., the south coast being so much drier that in some regions irrigation is necessary for the crops. So much for the physical features of the island, and these few items will suffice for the present. It is perhaps as well to allude here to the fact that Porto Rico is practically destitute of roads, as this deficiency has a considerable bearing on the question of medical attendance in the country districts.

The population of Porto Rico is 953,000, approximately that of West Virginia or Connecticut, and is composed of a mixture of races, those of Spanish descent predominating. Roughly speaking, the proportion of whites to colored is two to one, but I am bound to say that it is

often a matter of extreme difficulty to fix the exact line of division. The excess of females over males is very slight, forty-eight to forty-seven, and is most marked in those of mixed blood. Illiteracy prevails to a remarkable extent, and this is a great obstacle to the work of sanitation as it renders it impossible to reach the great mass of the people through printed matter. But this lack of education is being rapidly diminished, and it is certain that in a short time every child in Porto Rico will be able to read and write, leaving the older generation to monopolize the bad pre-eminence of ignorance.

With these few preliminary remarks, I pass on to the question of sanitary administration. The island is divided into sixty-seven municipalities, but this term is not to be understood in the American sense, but as meaning a large district of varying extent, and in which the population may vary from 7000 to 55,000. A city or town exists in each of these districts, but many of these are mere hamlets in a woeful state of dilapidation and dirt. An alcalde, or mayor, with a town council manages the civil affairs, and in each district a local board of health exists of which the alcalde is the president. Theoretically every muncipality employs one or more physicians to look after the sick poor, but in practice at present one-half of the island is absolutely without any public medical service. Almost all of the municipalities are poverty-stricken, many of them bankrupt through the incredible corruption existing under the Spanish régime, and the miserably small salaries offered to medical men were always in arrear, and often unpaid for years. In no civilized country was the profession so shabbily treated as in Porto Rico, and the wonder is that so much thankless and exhausting work has been done by our ill-treated brethren. Under the new financial system the position of municipal physicians will be greatly strengthened, as the budget of each town is under control of the Treasury Department, and appropriations for any purpose must be expended only for that. This idea is rather revolutionary to the Spanish mind, but is being gradually accepted as inevitable, and will in time be recognized as the only true one. The maximum salary of a town physician is six hundred dollars, and the duties are extremely onerous, for he has to perform a variety of functions that are peculiar to Spanish countries. He is health officer and meat inspector, this involving examination of all animals slaughtered, and has to perform autopsies on the bodies of all persons brought to the cemetery where the cause of death is unknown. Now, as there is only one town in each district, and as all medical men were obliged to live there, it may be easily conceived that the task of visiting the outlying poor scattered over a mountainous country in which only rough trails exist, and where a journey was at any time likely to be inter-

rupted by a sudden freshet in the rivers, was not an unmixed joy. Very often the journey involved serious danger, and never under any circumstances could it be anything but fatiguing.

The peasant class live in shacks constructed on severely simple architectural lines, the principal materials used being palm leaves, tin cans and scraps of packing boxes. Large numbers of these shacks consist of only one room, twelve by fifteen feet square, and in this the entire family are herded together. In hundreds of them you will find no furniture except a hammock, and no cooking apparatus beyond the little iron pot for charcoal and a frying pan. The promiscuous mingling of the inmates naturally leads to much immorality and blunting of the sense of decency, and it will take many years to overcome the evils wrought by long-standing customs. Until recently concubinage was the rule, for marriage was an expensive luxury that few could afford, but thanks to the strenuous work of the Catholic Bishop Blenk, and of the American missionaries of all denominations, marriage has been brought within the reach of all, and the people are taking kindly to the novelty. Owing to the difficulties attending the medical attendance of the poor, it is not surprising that they have looked for relief to sources outside the profession, and we have today in Porto Rico a strange army of quacks of every description, and professing almost every scheme of cure except Christian Science, which has not yet appeared on the scene. All of these practitioners are, of course, grossly ignorant, but many of them profess to work under the control of the spirit of some deceased medical celebrity, and the teachings of every school from Hippocrates and Galen to Trousseau and Charcot are represented by these quacks, who are unable to read or write. All sorts of remedies are employed, many of them of a disgusting nature, but none perhaps has a greater reputation than urine, which is employed as a kind of universal medicine from childhood to old age.

The immense amount of blindness existing in Porto Rico is largely due to the practice of washing the eyes of the newly-born with the maternal urine, and as gonorrhœal disease is extremely common, the result of the treatment may be imagined.

The food of the poorer classes consists chiefly of rice, beans, and codfish, coffee being taken when and wherever procurable. Drunkenness is rare, but has increased considerably since the American occupation. The deficiency of food in quality and quantity naturally leads to a lowering of the physical standard, and it is rarely indeed that a man is seen with a well-developed frame. Sexual maturity occurs very early and this is especially noticeable among the females, but as they blossom early they fade rapidly and a middelaged woman usually looks far advanced in years. Like all poverty-stricken people, they

are very prolific, and the swarms of children in the towns are a constant marvel to strangers. Infant mortality is large, tetanus carrying off victims in immense numbers. The ignorance and filthy practices of the so-called midwives are entirely responsible for this loss of life, and it seems almost impossible to make any material change here so long as any of the tribe infest the island.

Considering that Porto Rico has been governed for four hundred years by a power reputed civilized, it is a little strange to us that there is not on the island today a town with a sewerage system. In San Juan a portion of the town is sewered, but the plan for the system was badly conceived and worse executed. In a large portion of the city surface and other drainage have no outlet save per *vias naturales*, and the consequences are, of course, disastrous to the comfort and health of the city. At the time of the American occupation there was not a water-closet in San Juan, even the Palace of the Governor General being provided with arrangements of the most primitive and abominable sort. Now modern outfits are very numerous and every day adds to the number as people find out the value of a domestic atmosphere untainted by foul odors.

The absence of decent sanitary fittings was largely owing to the fact that there were no water works; but it is difficult to understand how it was that every town did not possess a good system of water works, there being an abundant supply close at hand of water of excellent quality.

San Juan has now a fairly good supply of water, but the works are on too small a scale, and are not furnished with filter beds. When the works were planned no one dreamed of the coming invasion of American ideas and customs which involve a lavish use of water, but the intention was merely to furnish enough for drinking purposes. It will be absolutely necessary in the near future to increase the capacity for storage and to introduce a system of filtration, but at present any change is impossible on account of lack of funds. Ponce has a poorly equipped system, Arecibo, Mayaguez and Guayama having also partial supplies, more or less imperfect. In the towns the chief supply is derived from rain-water cisterns, but as a consequence of the peculiar Spanish habit of putting the cistern in close proximity to the privy vault, it is rare to find a sample of water from a cistern free from fæcal contamination. Every house in the capital and other large towns has a huge vault under it, many of these being larger than ordinary sitting rooms, and intended to receive the accumulations of many years. Now here we have the conditions which elsewhere would infallibly mean the decimation of the people by typhoid and other filth diseases, but by some special providence it happens that typhoid,

diphtheria and scarlet fever are rare, the latter being practically unknown, and I presume that long residence in bad conditions has conferred a certain degree of immunity on the people.

As this paper is not intended to be a complete account of Porto Rico in its sanitary aspects, I will only briefly mention the principal diseases which exist here, and will not inflict on you more statistics than are necessary to illustrate the work done by our board by figures showing the results in a general way. Anemia heads the death list, and is aptly named "the scourge of Porto Rico." It presents various forms, and in fatal cases is of the most profound character. A very large proportion of it is that which is caused by the presence of the "anchylostomum duodenale," and the number of parasites found in these fatal cases is almost incredible. It is, of course, a well-known disease in many other countries and figures under a great variety of names, e. g., "Egyptian chlorosis," "Tunnel anemia," etc. It is only recently, however, that any specific attention to it has been given in Porto Rico, but enough has been ascertained to prove its widespread extent. The uncleanly habits of the people greatly favor its development, and many years must elapse before we can hope to extinguish the pest. The disease is amenable to treatment, the best specific being thymol, but, of course, a relapse occurs as soon as the patient returns to a life with his former environment. Tuberculous diseases are prevalent in nearly every district, and here again the habits of the people are responsible for much of the ravages of these diseases. Overcrowding and want of ventilation must produce their logical results, and it is impossible to get the average Porto Rican to get over the dread of fresh air at night, and the greatest care is taken to prevent the entrance of the supposed enemy. Intestinal diseases are common and fatal, the principal being dysentery and the various forms of enteritis. During the period immediately succeeding the hurricane, the mortality from these causes rose to a frightful figure, the death-rate in Ponce being at one time 113 per 1000, the chief cause of death being gastro-intestinal disease. Insufficient and unfit food was, of course, the original factor in the case, but with the advent of better times the rate has steadily fallen until on August 10th the death-rate was only 24 per 1000, a figure exceeded by many places in the United States.

Yellow fever has not been seen in Porto Rico for several years, and with the admirable system of the Marine Hospital Service it appears impossible for a case ever to get ashore, and it rarely ever rises here spontaneously. Malarial fevers are mainly of the remittent type, and in the form here known as "pernicious bilious remittent" are very fatal, but fortunately these severe cases are not very common. Smallpox has always been endemic and often epidemic in Porto Rico, but it is be-

lieved that the day of great epidemics is past. Under the military board of health the gigantic task of vaccinating the people of the island was undertaken and carried out under the able direction of Colonel Hoff, U. S. A., the Chief Surgeon. Nearly 800,000 persons were vaccinated in three months, and the results were highly satisfactory in the immediate reduction of the mortality. In the early part of this year a considerable number of cases occurred in various parts of the island, but only seven of them were confluent, and there was only one death. Last year five deaths occurred, and in 1899 there were 250 deaths. Such figures are very eloquent and need no comment. The island has again been gone over this year, special attention being paid to the schools, and today there are not a dozen cases in the whole country.

Leprosy exists here, but has never shown much tendency to spread and the people generally do not regard it as a serious matter. There are probably not more than sixty lepers in Porto Rico and the board is trying to round them up and place them in the colony established on an island close to San Juan, where they have every possible attention and comfort. The disease is mostly of the tuberculous form but I have seen a few cases of the anæsthetic variety.

Let me now pass on to the consideration of the practical work of sanitation as carried on in Porto Rico. My previous remarks will convey some idea of the difficulties confronting a board of health, but only those actually on the spot can fully realize them. Under the old Spanish régime sanitation had no real existence, but there was an elaborate system of laws, insular and municipal, which only needed execution to be perfect. Based upon these laws and those of the States foremost in sanitation, a code of military orders was framed, and a Superior Board of Health appointed by the Military Governor to which body was entrusted the carrying out of the new system. This Board took the place of the old Spanish Board, which was a body of very distinguished membership, but almost purely ornamental. The new Board also took over the duties of the bodies known as the subdelegations of medicine and of pharmacy, the functions of which consisted in a general oversight of all matters connected with these professions. The licensing of all physicians, dentists, pharmacists, practicantes, nurses and midwives is entirely in the hands of the Board, and examinations for licenses are held semi-annually. The standard taken is that of the New York University and is rigidly adhered to. All appointments of medical men to offices are submitted to the Board for approval, and in cases of disputed accounts between patients and physicians, the Board has full jurisdiction and can adjust them in accordance with a tariff which is reasonable. In case of a medical

official being charged with inefficiency or immorality and where proceedings are instituted by the local authorities toward his removal, the Board acts as appellate court, and its decision is final. Its powers of control over the profession of pharmacy are equally as great, and it can enforce severe penalties for any violation of law or of its orders which have the force of law.

Vaccination is compulsory in Porto Rico, and there is very little opposition to it. The Superior Board of Health is charged with this duty, the Secretary being the Director of Vaccination. The virus is prepared at our station near San Juan and sent out on ivory points, and has proved absolutely reliable, and satisfactory in every way. Accurate records of vaccination are kept, and these are now being tabulated for issue in the forthcoming annual report. Finally, the control of sale of patent medicine is vested in the Board, and no secret remedy can be sold unless registered after the disclosure of its composition.

It will be seen, therefore, that the present Board, which is the successor and heir to the Military Board, exercises a jurisdiction which is far more extensive than is exercised by any state board in the United States, and it is scarcely an exaggeration to say that its powers are limited only by its discretion. The Board consists of five members, one of whom is the Secretary and Treasurer, and who is the only salaried member. Two members are ex-officio, the others are appointed by the Governor.

It may at first appear unwise to concentrate so much power in the hands of any central body, but here in Porto Rico a strong central control is necessary, the people being utterly ignorant of the A, B, C of sanitary knowledge or of modern methods of doing business. Besides, they are accustomed to being directed in all things from San Juan, and I find that they rather enjoy the freedom from responsibility and from the necessity of initiating any measures for themselves.

A local board of health exists in every town, but it is only in the large cities that any real work is done by them, and much of the time of my office is taken up with matters that in other places would never be brought before a similar board. We have two medical inspectors who travel over the island, and who act on their own responsibility in nearly all cases requiring attention. I omitted to mention in its proper place a branch of work which gives the Board much trouble. All cemeteries on the island are under the control of the Board, and elaborate regulations as to the interment and exhumation of bodies have been published and are strictly enforced. The conditions existing in nearly every cemetery under the Spanish rule were too horrible

to be believed unseen, but now decency is no longer offended by the sight of human fragments lying on the ground, or the feelings of respect for the dead shocked by the huge bone heaps which formerly disgraced the country. It was the custom to rent out graves and niches for a term of years, usually five, but in case of default of payment the remains of the tenant were grubbed up and unceremoniously dumped on the bone-heap in the corner.

Want of space and time debars me from more than a passing mention of the work of the chemical laboratory, but this is really one of the most important branches of the work of the Board. Dr. Berkeley, a graduate of Johns Hopkins University, is the very able officer in charge, and he has performed prodigies of labor under the greatest difficulties. His work has been chiefly concentrated on food adulteration and water analysis, and the results of his work and the numerous prosecutions consequent on his reports have been most striking. A wholesome fear exists among the dealers in food stuffs, and the quality of articles of every sort is now greatly improved.

The Board has not yet been able to establish a bacteriological laboratory on account of the lack of funds, but it is hoped that this great need will be supplied in the near future. Plans for it are ready, and have been approved by the government, and we have more than one competent physician to run it when started.

Statistics are to most people dry reading, but a few figures will illustrate to a meeting of this kind certain points better than any amount of descriptive writing.

COMPARATIVE MORTALITY OF DEATHS IN PORTO RICO.

Towns.	May, 1900.	May, 1901.	June, 1900.	June, 1901.	July, 1900.	July, 1901.
Adjuntas	128	42	193	36	288	34
Mayaguez	201	118	216	93	217	93
Ponce	392	123	431	134	520	107
Utuado	198	75	219	81	277	92
Yauco	159	68	246	70	374	58
Juana Diaz	152	72	207	71	381	50

At one time the rate for Ponce fell to 17 per 1000, this being the lowest ever known.

I trust that this brief and necessarily imperfect sketch of conditions in Porto Rico will convey a clear idea of the vastness of the work thrown on the Superior Board of Health and of the many peculiar duties which do not usually fall within the province of the State Boards of Health at home. It would be ungracious in me to acknowledge with sincere thanks the great assistance we have received

from boards of health all over the Union, some of this being in the shape of exchanges of reports, etc., and much in the way of friendly letters of advice from persons to whom I was personally unknown, but who are deeply interested in the sanitary welfare of this beautiful island, so full of infinite promise for the future.

VACCINAL IMMUNIZATION FROM THE HEALTH OFFICER'S STANDPOINT.

By Dr. PETER H. BRYCE, Toronto, Ontario.

It is probably not overestimating the figures when it is stated that there have been in the United States and Canada 30,000 cases of smallpox during the present year, and that with the advent of cold weather many more cases will have occurred before the end of 1901. The type of the disease, except in a few instances, has been of an abnormally mild character, therein constituting one of the most serious difficulties to health officers in dealing with outbreaks. The difficulties resulting from this have been threefold: (*a*) That due to delay in diagnosis and disagreement as to the nature of the disease; (*b*) the difficulty of carrying out thorough isolation, and (*c*) opposition to the practice of vaccination. While all are worthy of discussion, I propose to deal with the last only.

I. *Theory of Vaccinal Immunization.* The systematic practice of vaccinating children at an early age, as is compulsorily required in England, Germany and other countries, has for a number of years been neglected on this continent. The result has been that, with a disease of mild character appearing, it has often obtained a strong foothold in a community before its nature has been recognized, and as almost no mortality has resulted, health officers have experienced the greatest unwillingness on the part of the people to submit to the inconvenience of vaccination, and, to defend their position, many influenced by some undefined fear of the results of vaccination and encouraged by anti-vaccinationists, who conjure up possible dangers, have hesitated or refused to submit to an operation, whose results they say will, or may be, more serious than an attack of the disease itself.

In order therefore to cope with the situation, medical men and health officers have attempted in some way to meet these several objections, and the first and most natural method has been to remove the fear of vaccination by seeking for vaccines which would produce the mildest results, and, by saying as generally expressed, "They would make but one mark"; and, to meet their wishes, it was soon found that the producers of bovine vaccine were ready to second their efforts by sending out directions with the vaccines as to but one insertion being required, with the promise that no serious inflammatory results would follow. Now I have little doubt that I have very accu-

rately defined the situation in which most executive officers have found themselves placed, and that many of them have marvelled that, after public vaccination stations have been opened, and hundreds of certificates of vaccination of school children have been produced, they have found new cases of smallpox continuing to appear and that smallpox has again and again appeared in exposed persons who have been vaccinated presumably in time to forestall the advent of smallpox. Those of us who years ago had to deal with smallpox outbreaks will recall how different was the situation then and how we could confidently state that if vaccination of exposed persons were practiced within three or four days of exposure, there would be practical protection against smallpox.

II. *Preparation of Vaccines.* The mode of preparation of vaccine from calves is now so well known that it need not be explained here; but it is proper that we should inquire why some vaccines are relatively so inert and why some seem to produce unduly severe results. Fortunately for us today, the work of many laboratories during the past twenty-five years is present to aid us, and we know much of the facts underlying the theory of immunization against different diseases.

III. *Qualities of Vaccines.* When we roughly summarize these, we find as influencing their action: (1) The individual factor, or the degree of natural immunity in the individual to a disease; (2) the virulence of the infecting agent or microbe; (3) external, accidental, or natural influences favoring or retarding infection. The term *'type,'* as applied to disease, was used long before the advent of modern biology with its Virchow's dictum, *omnis cellula a cellula;* and the experience of the clinician and the bacteriologist in recent years has only strengthened its fitness as applied to microbic maladies. Nearly two centuries ago, Sydenham remarked and wrote of it both as regards smallpox and scarlatina; Sir John Simon especially speaks of it, in relation to smallpox in 1871-74, and all of us today recognize it in different outbreaks of measles, scarlatina and diphtheria. In the laboratory preparation of toxins, variation in virulence is constantly observed in diphtheria cultures. The producer of bovine vaccine has long conjured with it in advocating his brand of Beaugency or other stock as having special virtues, and I imagine those of us who have had to deal with the present outbreak have often poured out in private maledictions on a smallpox germ, which so imitated the prevailing degeneracy of the age as to persistently refuse to live up to his old-time character for virulence.

As, however, there were in July last (1901) 167 deaths in New York City and its environs, it would seem as if it has not wholly forgotten how to strike hard. It is not then surprising that its naturally

degenerate offspring, cowpox, or vaccinia, should not unfrequently share the retrograde evolution shown by its more virile progenitor. How such degeneracy comes about would be an attractive subject for an academic discussion, but we must just now deal with the results. All who have observed cases of this present day smallpox will have observed that with an onset of often a serious character, and the appearance frequently of a profuse eruption, the pustules at the end of twelve days or a fortnight, instead of increasing to deep ulcerations, heal quite rapidly, leaving comparatively few and shallow pits, not extending into the deeper tissues. In the same way, some vaccines in the market have produced simply superficial scars which have disappeared within a few weeks or months, have failed to be protective against a more active vaccine within a few days or weeks, and which have proved wholly powerless to protect against infection with even the present mild type of smallpox. In the very extended and thorough articles by Beclère and Chambon of the Vaccinal Institute of Paris, published in 1898, the inertness of vaccines taken from vesicles in calves, vaccinated by injection of normal lymph several days before, becomes of interest and shows very clearly the readiness with which a normal virulence may be altered. On the other hand, and for the executive officer equally important, is the fact that lymphs may be produced of an abnormal virulence, by some reverse process such as symbiosis, whereby some germs of ordinary virulence take on, as they are known so readily to do, an abnormal virulence, thereby breaking down the local resistance of the tissues, and while producing an efficient vaccination, may do much more in producing a quite serious localized abscess.

From these remarks on the type or quality of the virus of disease, as applied particularly to vaccinia, it is quite apparent that, as executive health officers, we are particularly interested in knowing that physicians, in the absence of a systematic vaccination of the people by public vaccinators, should make every endeavor to see that the vaccines used by them are normal in their virulence and action. We readily admit that the question of manufacture is a scientific one of much delicacy, requiring on the part of the producer a very intimate knowledge of all these problems of variation in virulence of germs, which come within the experience of every bacteriologist, while there is further in the preparation of glycerinized lymph, many other points demanding experience and personal attention, much more perhaps than in a busy period is given by the producer. What then seems most necessary is that the medical profession, and especially medical officers of health, should hold the clearest and most explicit views as to what is intended by vaccination, what the methods necessary to

secure this are, and what are the evidences that when a patient has been vaccinated he is in fact an immune for a good many years at least to smallpox. Some of us can recall that fifteen or twenty years ago, when smallpox outbreaks were prevalent and of a normal virulence, the then established practice, as recognized by compulsory vaccination laws, was that evidence was necessary on the eighth day subsequent to a vaccination that it was successful through its presenting a certain typical appearance of the vesicle, and that several insertions were necessary to complete the immunization. In view of the very diverse ideas which those especially who have seen vaccination only within recent years may entertain, it seems most desirable that this Association with so many executive health officers present, should express its views on this matter very definitely, and, if possible, make a 'pronunciamento' on the subject. Can we have a real and essential immunization against variola without the production of the clinical signs and symptoms of a definitely well-defined disease known as vaccinia? Levy and Klemperer remark in their latest edition: "The oldest method of immunization is represented by vaccination for smallpox. Recovery from mild vaccine disease protects against severe variolous infection. The causative agent of smallpox is not known, but, from all else that is known concerning immunity and immunization, it may be inferred that the causative agent of cowpox is identical with that of variola, and represents an attenuated form of the latter."

There seems abundant experimental evidence on this point, and here we have to ask ourselves whether it does not seem a necessity, from all we know of acquired immunity, either by a disease or its vaccine, that certain doses with certain positive symptoms are necessary. Probably all will agree to this and the only question in the present instance for us to decide is: What is a sufficient amount of immunity? It has generally been said that an attack of smallpox is practical protection against another attack, and yet we have known and read of persons having had two or even three attacks. In measles, we also know of mild epidemics which are not highly protective against a more severe one. Evidently, in variola there must be a moderately severe attack of the disease, as in other cases, to be protective. We have learned, indeed, that in some cases of the present mild variola that within a few weeks thereafter it has not been wholly protective against an active vaccine, just as many instances are known where, many years after an attack of severe smallpox, a person has been more or less successfully vaccinated. The truth seems to be as Klemperer again remarks: "Immunity is always relative: absolute immunity is theoretically inconceivable." It is well for us to remem-

ber that such immunity is only against a specific disease. While we know that a relatively great immunity can be obtained for different diseases, by successive injections of graduated cultures, as in Pasteur's anthrax and rabies vaccines, and as the same practice seems to succeed in vaccination against smallpox, it might theoretically be a good procedure to recommend, should the dangers from the use of a normally active lymph appear objectionable to anyone; but as the history of one hundred years of vaccination has not shown that such is required, it becomes proper for us to inquire just what we have a right to expect in order to produce a normal vaccination and a practical degree of immunization.

Art of Inoculation. However precise the education of the student may be in other respects on this continent, it is a matter of notoriety that no teaching, or almost none, is given at our medical schools on the principles and methods of vaccination. From what we have already discussed regarding the necessity for evidences of a positive constitutional infection being evidenced in an effective vaccination, one would expect to find, as we do find, that the old-time practice, followed for many years in England, of several insertions is still carried out, and that at the eighteen Government Public Vaccination Instruction Stations in England, four or five insertions on a single arm of one-sixteenth to one-fourth of an inch in area, and at least one-half an inch apart, is the compulsory practice. Should anyone think this has changed within recent years, he has only to observe the detailed statements of work done at the National Vaccination Establishment in London, as set forth in the Local Government Board's Report for 1900 to be assured that "the old order does not change, giving place to new."

Our confrère, Charles D. Smith, M. D., President of the State Board of Health for Maine, has done a valuable service in the report on "Vaccination and Vaccine Lymph," published in that Board's annual report for 1900, and fully illustrates the procedures at British vaccination stations, and very heartily approves of the methods there adopted. As to dangers to be avoided from the surgical standpoint, it is hardly necessary to refer, except to say that it is evident that all questions of immunity due to vaccination are of a different nature from those of the dangers due to neglect in the matter of inoculation with a septic vaccine and the asepticism of the primary and secondary stages of the operation of vaccination itself. When the physician at the London Vaccination Station can report that of 3603 vaccinations done there in 1899, only twenty-five returned for examination on account of some abnormal course of the vaccination, and, that of these, one was erysipelas on the eleventh, and another on the

sixteenth day after the operation, and that the others were simply due to some maltreatment at home, it is apparent that with a lymph tested as to freedom from bacilli after glycerinization, we must look to some other more probable cause than the lymph itself as the occasion for the introduction of septic germs. For the credit of surgery and Listerism, for the justly cherished memory of Dr. Edward Jenner, for the progress of public health work, as well as the safety of the individual, we are bound to investigate and see how far the public vaccinator, appointed at so much an hour, or so much a vaccination, is responsible for neglect in his technique and advice to free applicants for vaccination, and how much to the stupidity and carelessness of the vaccinated. For rather should such vaccinated persons be put in tents under medical supervision till the vaccinia is over, than that vaccination shall become the occasion of criticism by those who are so blind as to be unable to see, and the fear of the unlearned, whose safety we seek in making its practice general.

Observations of the Results of Vaccination. It is necessary to refer briefly to this point because I am convinced that to no other source so greatly, as neglect of subsequent inspection, have vaccines producing abnormal results been so commonly allowed to go unnoticed.

The English law, as also that in Canada, requires return of the patient for eighth day inspection. Dr. Charles Smith, in his report, advises inspection on the seventh day, and if the vesicle is unsuccessful or *atypical*, then revaccinate. As some of us know, there has been another doctrine held, and taught quite recently, as regards delayed vaccinations. Such, Dr. Smith, Dr. Ackland and Dr. Copeman and many others, nevertheless, consider abnormal, and experimental evidence of abnormal vaccination in calves confirms both their views and practice of revaccination. As far as my study and experience of twenty years have gone, such teaching regarding aseptic vaccines, which produce little or none of the areola or the raised border, but little umbilication and almost no lymph, is a rank heresy against which this Association must cry anathema in no half-hearted manner, for the credit of the illustrious Jenner and the conclusions of the best teaching of modern bacteriology.

Duration of Immunity. This problem leads at once to a discussion of the larger question of the theory of immunity in general. As Klemperer, already quoted, remarks: "Theoretically, absolute immunity is an impossibility, but, as we know, it is practically absolute for smallpox in the great majority of persons who have suffered from an attack of smallpox"; but, more than that, as the experience and practice of thousands of physicians during the past year have taught us, the vaccination of childhood and revaccination at adolescence have

generally sufficed to protect themselves and other exposed persons. Of course, the routine practice of vaccination of all persons on exposure to a new case is carried out doubtless by many. It is hardly necessary to illustrate this well-known experience, but the statistics of the London Smallpox Hospital, so generally quoted, may be given as illustrating the fact as well as the value of a good mark, and a number of insertions. Thus the Royal Commission sitting in England from 1891 to 1896 found that, in seven thousand cases observed, the smallpox fatality in persons with one mark was 6.2 per cent., with two marks 5.8 per cent., with three marks 3.7 per cent., and with four marks 2.2 per cent. Of these there were:

Cases.	Under 15 years.	Over 15 years.	Deaths.	Per Cent.
Unvaccinated	386	174	—15	37
			+15	38
One or more bad marks	222	483	—15	4
			+15	10
One good mark	76	141	—15	.0
			+15	6.4
Two good marks	44	151	—15	0
			+15	4.6
Three good marks	70	100	—15	0
			+15	2

The less fortunate experience of some physicians and medical officers of health as regards the immunity of those exposed to smallpox, supposed to have been present after the use of some one or other lymph in the market, must not be forgotten.

But it suffices that the various principal practical points in the matter of immunization by vaccination have been referred to rather than exhaustively dealt with in this brief paper. The subject is one which bears upon, not alone or even chiefly, the present mild epidemic of smallpox, but the future protection of our people against smallpox, which at any time may appear with its old-time virulence. If "to be forewarned is to be forearmed," then the expression of the positive views of the many executive officers present in this Association on so vital a subject, should be not only made by formal resolution, but every means should be taken to bring these views before the physicians of the continent and the numerous health authorities charged with the care of the public health. It is to be hoped that a free expression of opinion will be heard in any discussion which is to follow, which is my reason and excuse for bringing a rather threadbare and hackneyed subject before the notice of this Association.

REMARKS INTENDED TO SHOW THE INNOCUOUS CHARACTER OF HUMANIZED VACCINE AS A PREVENTATIVE OF SMALLPOX.

By Dr. FRANCISCO De BERNALDEZ, Mexico, Mex.

At the meeting which this Association held in Indianapolis last year, I read a paper giving the reasons why in Mexico we prefer to administer humanized vaccine in place of animal vaccine. I simply remind my hearers of this fact in order to repeat, that the observation of many years has taught us the efficiency of humanized vaccine; that the immunity which it confers against infection is permanent and not temporary, and that by its means we can obtain a greater degree of immunity against smallpox than with animal vaccine.

In that work I presented numerical demonstrations taken from statistics to prove the aforesaid proposition. I now come to present to this Association, the observations and studies on this subject, which have been carried out during the past year in the City of Mexico and Federal District.

During the year I refer to, humanized vaccine was administered to 44,765 persons.

The figures showing the number of children under one year and those of a greater age are unequal, and that is due to the fact that in Mexico, vaccination is made compulsory during the first months after birth, the parents or guardians of the children being held penally responsible if they do not present them within the specified period.

Notwithstanding the great number of vaccinated persons, not a single case has been observed of bad results that could be attributed to the transmission of a disease from the child who supplied the lymph to any one of the persons who were vaccinated with it. I believe that this numerical demonstration is abundantly sufficient to refute all ideas to the contrary.

I must again insist on the importance, in order to reach this desired end, of having the vaccination performed not only by a physician, but by an expert, because upon him depends the selection of the person who is to supply the vaccine, a selection that is made after a very careful examination of the person, as regards his own health, the condition of the vaccine pustules and other morbous antecedents, both of himself and family. The examination which the vaccinating physician must make of the child that supplies the lymph, is for the purpose of investigating whether he is affected with syphilis, a disease that can be diagnosed without difficulty, as all authorities on that subject have observed that this infection makes itself evident within the three first

months after birth. If I enlarge in reference to these syphilitic infections through the channel of the vaccine, it is because, as it is well-known to all, this has been the principal or perhaps the only reason for abandoning the humanized or Jennerian vaccine and substituting it with animal vaccine.

My special object at present, in insisting on the advantages of humanized vaccine, is that I have read in foreign papers articles which relate the ravages of smallpox amongst the troops now on campaign in South Africa, Asia and the Philippine Islands, the individuals of which had only been inoculated with animal vaccine. According to the reports we have, those armies have lost more men by smallpox than by bullets.

It is, therefore, our duty to state what we have learned from experience and observation, especially as Mexico is the only country in which the Jenner vaccine has been preserved. It is a matter of daily observation, that in Mexico revaccination does not take, or only in exceptional cases, which can only be explained by the fact that the person was held to have been well vaccinated with lymph taken from a false vaccine pustule. Notwithstanding this conviction, the Vaccination Office of the City of Mexico is carrying out some special investigations, with the object of confirming that opinion, that humanized vaccine confers a permanent immunity against smallpox.

On account of the slight epidemic of smallpox which we had in the City of Mexico during the past year, and having observed in the records of the Supreme Board of Health, that the greater part of the cases were made up of adult persons, amongst whom were many foreigners, it was thought that this circumstance was probably due to the fact that a large number of Mexicans do not enjoy the advantages of vaccination, because in their childhood, no law existed which made it obligatory for them to be vaccinated during the first few months. In view of this doubt, two extra vaccinating physicians were appointed, who were commissioned to examine and vaccinate all the persons employed in mercantile houses, factories and other industrial concerns who had not already undergone that operation. In a period of seven months, these gentlemen visited 223 establishments in which they examined 13,031 persons, out of whom 10,291 had the scars that show good vaccination, 1258 carried the scars that are left by smallpox, and the remaining 1502 were vaccinated. From these figures it will be easily understood why cases of smallpox are still found in Mexico; but the day will come when this terrible disease will permanently disappear from Mexican territory, driven out by the legal penalties imposed by law, the education of the masses and the undoubted efficacy of our humanized vaccine.

REPORT OF THE COMMITTEE ON DISPOSAL OF REFUSE MATERIALS.

By RUDOLPH HERING, Chairman, New York City.

Since the last report of your Committee on Disposal of Refuse Materials as presented a year ago, no marked progress has been made, improving the methods of disposal. The general conclusions reached in the report submitted in October, 1897, continue to be justified.

Reduction processes, chiefly for the recovery of grease, continue in operation in the larger cities of our country, where this material is sufficient in quantity to justify the establishment of reduction works. In smaller American cities the cremation process is being introduced at a fairly rapid pace.

Renewals of contracts for continuing the work of reduction in New York and St. Louis have been relet in the former at greatly increased cost. In Boston, possessing the latest and most perfect of the reduction works, no final steps have as yet been taken to obviate the complaints of bad odors, either by removal to a more distant locality or by removing the cause of the odors. Complaints are still frequent, also from among those cities where cremation is practiced, on account of odors due to improper design of works or their bad management.

In Europe the cremation process is still the only method in general use of destroying the obnoxious qualities of the material. However, no satisfactory method is yet practiced in Paris or Berlin, where investigations still continue. In the Hamburg works, the largest in Europe, the city's refuse is still burned without objection and within reasonable cost.

No city in America has yet undertaken a systematic comparative test of the several types of destructors that are recommended and have been in use for cremating the garbage and refuse, such as is obtained in a large and in a small city, or in a cold and hot climate. In a very few instances are even the constituents of this refuse well known, either as regards their sanitary effect or their financial value when raw, when prepared or when burned.

It was thought of value at the present time to place on record the history of the experience gained, and the present aspect of the garbage question, in a few characteristic American cities. Dr. W. C. Woodward, member of the committee, has kindly undertaken to do this for Washington, D. C., and Dr. H. W. Hill, member of the committee,

for Boston, Mass. Similar accounts for a few other cities had been previously promised, but, unfortunately, have not been received.

A fully satisfactory solution of this disposal question can hardly be expected, as repeatedly suggested by your committee, until an intelligent and thorough investigation will have been made on a large scale, in several American cities representative of their class, of all the factors bearing upon the case.

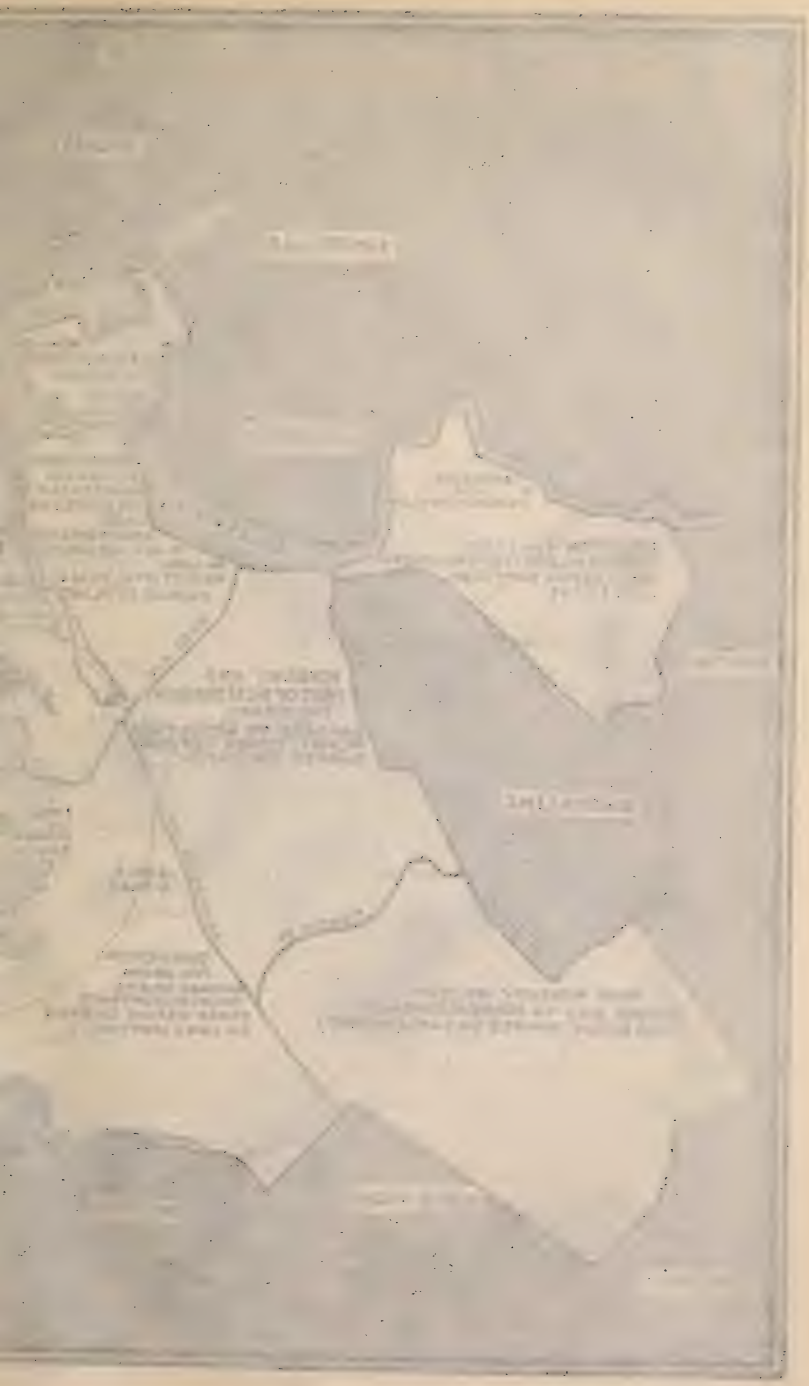
The following history of the disposal of the garbage and the present works in Boston, Mass., was prepared for the committee by Dr. Hibbert Winslow Hill, one of its members:

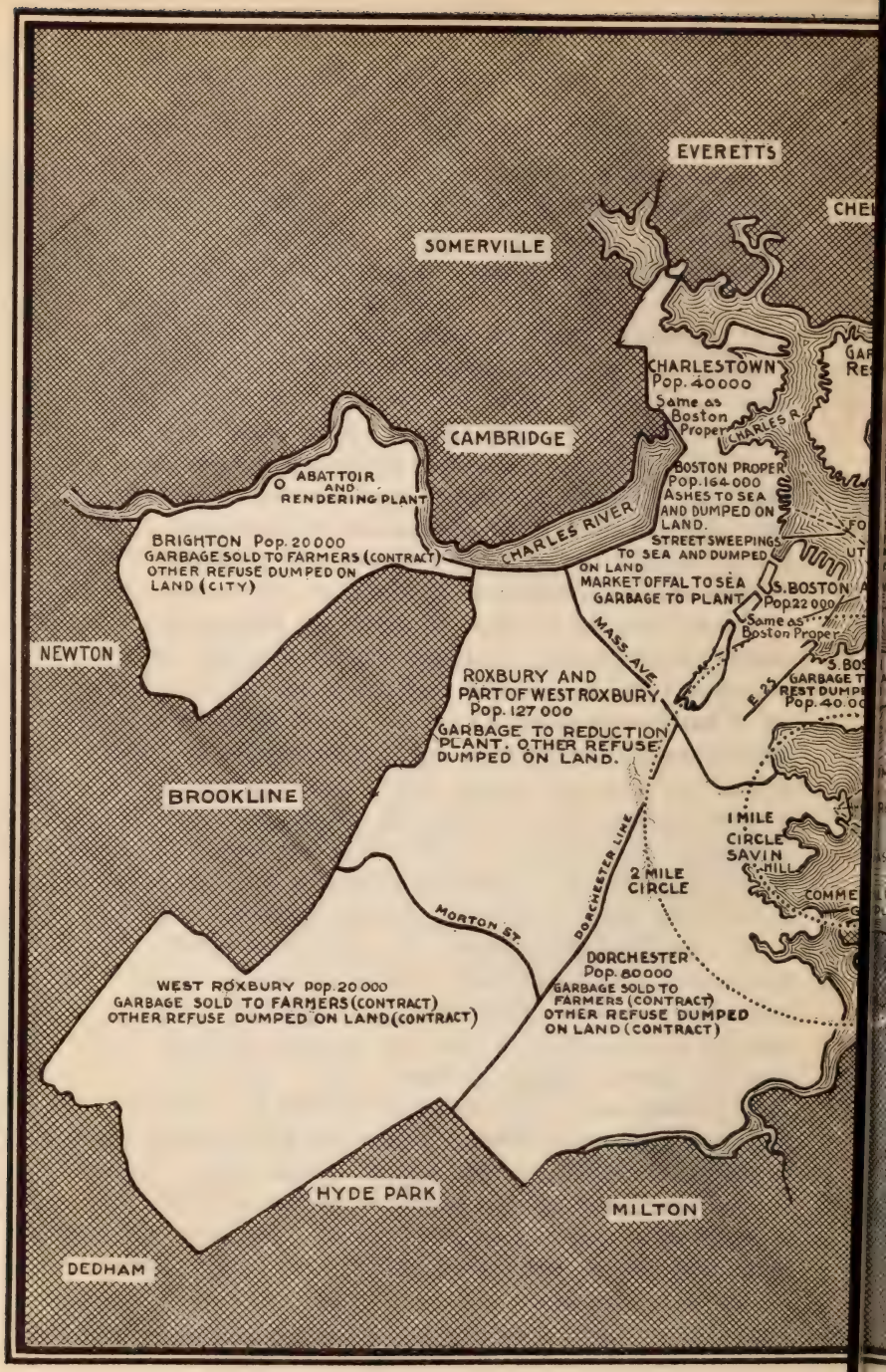
REFUSE DISPOSAL IN BOSTON.

By HIBBERT WINSLOW HILL, M. D., Boston.

Up to 1884, the garbage was collected by the city, or by contract, at some central point, unloaded, handled and reloaded into farmers wagons for use as food for swine. Ashes, street sweepings and dry refuse were then used for filling in land. Both practices prevail to the present day in certain sections of the city.

In 1884, the Board of Health introduced the Barney dumping boat in which the garbage was taken to the lower harbor from a dump at Fort Hill wharf. In 1886, the work was turned over to the street department. While dumping at sea was less objectionable to the dwellers in the city than the previous method, it was more objectionable to the seaside residents and many complaints resulted from those living in smaller municipalities having shores upon the harbor, due to the nuisance caused by the resulting flotsam and jetsam. While some of this nuisance was attributed to neighboring towns and to fruit vessels, it was largely put down to Boston's account, probably, with reason. The Board of Health repeatedly advised the establishment of a single large or several small crematories, and also as preferable even to this, the use by householders of a device to be fitted in the kitchen stovepipe for drying the garbage of the house for subsequent use as fuel in the kitchen stove. This device was used by several hundred people, but was gradually abandoned, partly perhaps because interested parties secured the rights of manufacture and suppressed the sale, partly because odors developed during the drying or subsequent burning of the garbage issuing from the chimney are said to have produced complaint amongst the neighboring residents. It is said that this method set free no odors in the house where it was used. Such an odor as that complained of, necessarily small in amount and limited in daily duration, must in any case be preferable to the raw garbage odors which any system involving cartage entails, particularly if the collections are made at intervals other than daily in summer, when the garbage pail necessarily in itself becomes a nuisance. The introduction of gas and oil ranges has diminished its range of efficiency, particularly in summer, although a substitute device for use in such cases was perfected. The indifference and lack of intelligence exhibited in these matters by a large proportion of the population would prevent its entire success as a distinct municipal substitute for the much more cumbersome and expensive measures now in vogue,




EVERETTS
SOMERVILLE
CHARLESTOWN
Pop. 40000
Same as
Boston
Proper
CHARLES R.
CAMBRIDGE
ABATTOIR
AND
RENDERING PLANT
BRIGHTON Pop. 20000
GARBAGE SOLD TO FARMERS (CONTRACT)
OTHER REFUSE DUMPED ON
LAND (CITY)
CHARLES RIVER
BOSTON PROPER
Pop. 164 000
ASHES TO SEA
AND DUMPED ON
LAND.
STREET SWEEPINGS
TO SEA AND DUMPED
ON LAND
MARKET OFFAL TO SEA
GARBAGE TO PLANT
S. BOSTON
Pop. 22 000
Same as
Boston Proper
NEWTON
MASS. AVE.
ROXBURY AND
PART OF WEST ROXBURY
Pop. 127 000
GARBAGE TO REDUCTION
PLANT. OTHER REFUSE
DUMPED ON LAND.
BROOKLINE
1 MILE
CIRCLE
SAVIN
HILL
2 MILE
CIRCLE
DORCHESTER LINE
MORTON ST.
DORCHESTER
Pop. 80000
GARBAGE SOLD TO
FARMERS (CONTRACT)
OTHER REFUSE DUMPED
ON LAND (CONTRACT)
WEST ROXBURY Pop. 20 000
GARBAGE SOLD TO FARMERS (CONTRACT)
OTHER REFUSE DUMPED ON LAND (CONTRACT)
HYDE PARK
MILTON
DEDHAM

MAP
SHOWING
REFUSE DISPOSAL
IN
BOSTON
EAST BOSTON
Pop. 45 000
FARMERS (CONTRACT)
PEDON LAND (CITY)
WINTHROP
APPLE ISLAND
WHARF
GOVERNORS ISLAND
DEER ISLAND
OCEAN STEAMERS
METROPOLITAN SEWAGE OUTLET
CASTLE ISLAND
BREWSTER ISLANDS
SPECTACLE ISLAND
RENDERING PLANT
LOVELLS I.
BOSTON LIGHT
GALLUPS I.
OCEAN STEAMERS
LONG ISLAND
GEORGES I.
THOMPSONS ISLAND
BOSTON SEWAGE OUTLET
RAINSFORDS ISLAND
HULL
MOON ISLAND
NANTASKET
PEDDOCKS IS.
QUINCY BAY
HOUGH'S NECK

but notwithstanding these difficulties, the general principle of individual cremation is an attractive one and may be revived as intelligence and education advance.

On July 17, 1894, the New England Construction Company organized under the laws of Maine, sought permission for the erection of a garbage reduction plant and was awarded a site on Gibson street, Dorchester, to be used for an experimental plant to handle about twenty tons daily. The contract was for ten years, the city giving the land rent free, delivering the garbage daily except Sundays and paying $2500 per year and 25 cents per ton for all garbage treated above twenty tons per day.

The treatment was to be without nuisance and to the satisfaction of the Board of Health and Superintendent of Streets. The building, etc., was to be complete and the work to be begun within four months from July 25, 1894. The company supplied flushing apparatus for the carts, the city supplied the water. If the company neglected or refused to receive, treat or remove garbage, or if the Board of Health decided that any part of the treatment, removal or condition of premises or bringing of garbage to premises was unhealthy or a nuisance, the contract became void after due notice, hearing and failure of the company to abate the nuisance within thirty days. In case of fire, the contract was to be suspended until repairs were completed. The plant was finished in January, 1895, and began operations in February. February 18, 1895, the Board of Health notified the company that the plant was a nuisance; February 20, a hearing was held and the company agreed to abate the nuisance, which consisted in odors from the digesters (Arnold system) collected in water at the condensers and discharged into the sewers. March 21, the nuisance continuing, the license was revoked and complaint was filed with the Supreme Court of Massachusetts by the City Solicitor at the instance of the Board of Health. The complaint and action of the board was sustained and the experimental plant discontinued. The board recommended that eight or ten crematories be established. The garbage was collected and sold to farmers as before, all dry refuse being dumped at sea. In 1898, about June 1, the New England Sanitary Product Company began building a plant for garbage reduction at the Cow (or Calf) pasture, Dorchester, in pursuance of contract dated June 1, 1898. Meantime a contract dated December 1, 1898, established a plant at the Fort Hill wharf for the sorting and utilization of marketable portions of dry refuse. The sorting is done by men picking from a traveling belt the saleable material, the rejected matter passing on to a swinging funnel, which discharges continuously into one or other of two openings in the top of a brick furnace, where it is cremated. The material is delivered

to the contractors at their plant by the city, a triple separation by the householder (garbage, ashes and dry refuse not ashes) being enforced throughout the contributing district. The city pays the company $5500 yearly, giving the ground rent free.

Several grades of paper are obtained, besides bottles, metals, cord of various kinds, cloth, tins, etc. These are thrown into hoppers and passed to the basement, where they are baled for the market. The receiving department is on the street level, the carts being driven in and dumping the load directly on the belt or in its neighborhood, whence it later reaches the belt. This plant seems to be satisfactory, is conducted without nuisance and is said to be financially successful.

Complaint is made, however, that material of value to this plant is mixed, in spite of the regulations, with material destined for the sea-going dumping scows or for the reduction plant, where it is more or less harmful, and with the ashes, where it is wasted by dumping at sea or on unused land. To such an extent is this true that the company finds it worth while to maintain one or two scow-trimmers on the ash scows to salvage material of this character.

The garbage plant began running November 15, 1898. At that time the improved Arnold system for obtaining oil, now in operation, was in force. The tankage after pressing was charred in ovens and the vapors washed for ammonia by the Sennit-Solvey process, and for tar. The charred mass was withdrawn, mixed with "stick" from the grease catch-basins, dried in Anderson driers and supplied to purchasers as a basis for fertilizer, for which it was utilized by the addition of ammonia and phosphate. This part of the plant was burned on February 10, 1899, and the rest of the plant so injured that operations were suspended for five days. One load of garbage only, it is stated, went to sea during this time. The extraction of ammonia, etc., was abandoned and the tankage was dumped at sea until September, 1898, since which it has been burnt in the furnaces of the company.

Early in 1899, residents in an area from one-half to one mile distant began to complain of odors from the plant. But three or four families resided nearer the plant than one-half a mile, while beyond that limit, to the westward, lies a fairly populous residential district and to the northward a very populous district. (See map.) In June and July hearings were held by the Board of Health, attended by complainants and representatives of the company. The evidence went to show that the odor complained of was distinct from that of the sewage pumping station and the gas works near the garbage plant and from the smell of the flats at low tide, the odor of the offal rendering works on Spectacle island and the sewage at Moon island. One witness distinguished

seven different disagreeable odors in the harbor from each other, recognizing the garbage plant odor as one of these. From the description given, the well-known caramel odor was evidently one of those complained of.

A second distinctive, sickening odor, not easily described, is recorded by the complainants, and by the Board of Health, as the chief objection. Alterations by the company directed to abating these odors were promised and made, without, however, the desired effect, and the Board of Health formally declared to the Mayor and Superintendent of Streets that the plant constituted a nuisance. The complaints continued later in the year and at intervals during the winter.

In the spring of 1900, renewed complaints, hearings and a second exhaustive investigation by the Board of Health led to a second formal declaration that the garbage plant constituted a nuisance and an effort was made in August, 1900, to abate it on the basis of the contract. The form of the contract was such, however, that under its terms, the Board of Health could not terminate the contract because of non-abatement of nuisance. An appeal to the Supreme Court was made, a demurrer filed, a hearing appointed and delays secured up to the present time, the operation of the plant and the odors continuing.

PRESENT WORKS.

Situation. The Boston Garbage Reduction Plant is situated at Cow Pasture, Dorchester, Boston. The Cow Pasture is a peninsula about one-half mile wide and four-fifths of a mile long, extending eastward into the old harbor. The peninsula is marshy and inhabited only by six or seven families residing on the northern side of Mt. Vernon street, within two thousand feet of the plant. At the extreme end of the peninsula are situated the factory, etc., of the Bay State Gas Co. to the south, the sewage pumping station to the north and the garbage plant between and to the east. Populous districts front on the garbage plant in two lines, at right angles to each other, and tangential to a circle centering on the garbage plant of four-fifths mile radius. The South Boston front on the north runs east and west, being about one and a half miles long. The Dorchester front on the west runs north and south nearly two miles long. At a point in the Dorchester line, a little south of west from the plant, a triangular peninsula (Savin Hill) projects eastward to within one-half mile of the plant. At the southern end of the Dorchester line, the shore runs nearly southeast for two miles, reaching Neponset, which is about two miles directly south of the plant. About the center of this latter line, a short peninsula (Commercial Point) extends northeast, its extremity being about one mile from the plant. The population of those parts of South

Boston and of Dorchester within two miles from the plant, is not less than 50,000, perhaps 70,000.

Buildings, etc. These are said to have cost $250,000 to erect and equip, with $50,000 more since spent on equipment. The grounds are city property, being previously vacant land near the pumping station and close to a small slip and wharf, also city property. The area of the grounds is 200x120 feet. The buildings (area about 100x80 feet) include one main two-story building, containing the digester, boiler, engine and grease rooms; the digester room is two stories high; the upper story above the other rooms contains the settling tank for the grease. In the yard is a small building for offices and the remains of a frame building, formerly part of the plant, but now burnt down. The machinery consists of two one-hundred horse-power Corliss engines for running the pumps, conveyers, presses, ventilating shafts, etc., feed water pumps, a Warren condenser pump and six Coatsville boilers, besides the reduction machinery proper, to be described later. The working hours are 7. a. m. to 5:30 p. m., except Sundays. Twenty-five men are employed during the day, four at night; all these are skilled workmen. Besides this force, ten men are employed on scows.

The Digester Room. The digester room is well lighted and floored with concrete. The digesters (Arnold type) are thirty-two in number, arranged in two rows of sixteen each and further into eight sections of four each. Each section contributes to a single receiving tank. The cylinders have a capacity of eight tons, are fourteen feet high by six wide, and are conical at the lower end where they open into the receiving tank. They are fed with garbage by a traveling conveyer from the scows. They are filled by dumping the garbage from the top to a depth of about ten feet; the head is then bolted on and steam under about sixty pounds pressure is admitted at the lower end, being injected at an angle with the axis of the cylinder. After "cooking" for ten to fourteen hours, longer in summer than in winter because of larger proportion of vegetable matter and more advanced decay, according to the character of the garbage (the man in charge is said to judge of the completeness of the process by the smell of the vapors given off from the pet cock at the upper end of the digester), the steam is shut off and the tank allowed to cool until the pressure within it approximates normal, i. e., in from one to four hours. The digester is dumped by removing the head. The contents consist of solid matter with five or six inches of water lying above it and oil floating on the water. The receiving tanks drain into gutters and the solid matter is passed through a roller pressing machine with a rotary belt (Edgerton press, built by the Link Belt Engineering Co., of Nicetown, Pa.). The pressure is controlled by ten-ton springs allowing the passage of

cans, bricks, granite blocks, stovelids and even cannon balls without injury to the press. The liquid and grease thus expressed pass to the gutter also. The pressed solid matter, known as tankage, is carried by conveyers to the engine room, where it is burned in the furnaces. The water and grease run out in gutters along the floor to the grease room, depositing as they run more or less sand and the heavier finely divided parts of the tankage. The gutter is cleaned out after each use. In the grease room, the water and fat pass through a series of nine square catch-basins connected with each other by openings in the lower part of the partitions between them, which results in the accumulation of oil on the surface of the water in each basin. This oil is skimmed out by hand with long scoops into a receiver and pumped to sedimentation tanks on the floor above, from which the oil is drawn down into a large iron tank in the grease room, furnished with a depression along the center of the bottom, where the water and sediment may collect. The oil is piped off into barrels from a point a few inches above the bottom of this tank. It is slightly turbid, dark brown, liquid, and without any offensive smell. The water remaining in the catch-basins escapes to the sea. The sedimented material, containing a good deal of fibrous matter, is placed in a receiver and blown by steam into a series of three digesters in which it is reheated and repressed, the latter in screw presses, similar to those in use in the New York plant. The grease returns to the catch-basins and the tankage skimmed.

Measures for Suppressing Odors. The steam from the digesters is conveyed by pipes to a Buckley condenser, where it meets with a current of sea water and is carried off into a "hot well," whence part of the odor is carried by the water into the sea. Part, however, escapes from the hot well and is conducted to a Bunsen burner burning at the foot of a chimney, where it is intended that it should be consumed. The odors from the digesters and grease room are collected by means of hoods arranged in the digester room, one over each press. These hoods lead by vertical pipes into a horizontal pipe furnished with exhaust fans. The odors are thus carried to the furnaces and are there supposed to be destroyed. While the liquid is running from the receiving tanks and presses to the grease room, the gutters are covered with iron plates.

In and about the building a strong caramel odor is detectable continuously during operation and is derived probably from the tankage after dumping the digesters. This odor naturally escapes by open doors and windows and is distributed by the wind. The well-known raw garbage odor is also to be noticed when the scows are being unloaded, but its range is very limited. The third and most objectionable odor is traced by the Board of Health to the chimneys of the

plant. It is not observed near the plant, but is carried to a distance by the winds and on cloudy days is especially likely to be carried downward to the ground-level, where it is extremely offensive. It is supposed to be due to a portion of the gases which escape from the digesters and pass through the condensers and burner above described. Some of it may possibly be due to the use of tankage as fuel.

Thus, odors at the plant, garbage-caramel; odors at a distance, caramel-unconsumed vapors.

Collection of Garbage. The city collects for delivery to the garbage plant the garbage from a population of from 390,000 to 400,000 people. The garbage is dumped at Albany street and Fort Hill from raised platforms through openings into scows lying in the slips underneath. These scows are owned and operated by the company. They are known as deck scows carrying their deckload within bulkheads and are about sixty feet long, costing $5000 each. Each scow is supposed to lie at the wharf thirty-six hours, by which time it should be full and should be taken to the plant by a tug supplied by the city, another scow taking its place. It is said, however, that the Albany street scows receive two-thirds of the total amount delivered and are overloaded frequently, while the Fort Hill scows receive only one-third of the total amount and often are forced to wait forty-eight hours for a load. The garbage is therefore delivered irregularly. A scow arriving at night is left at the wharf loaded until next morning. Chloride of lime is said to be used in such cases as a disinfectant and does not interfere with its subsequent treatment. After unloading, the scows are flushed with sea water. The company keeps two men (scow trimmers) on each scow at the dumps to pick out cans, cloth, etc., etc., which are then deposited in the ash scows and dumped at sea. On arrival at the plant, five scow men shovel or fork the garbage into a conveyer and one man stands at the conveyer where it enters the building to pick out cans, etc., so far overlooked. These cans are mixed with the furnace ashes and are used for filling in land. Small dead animals are frequently mixed with the garbage, but are not believed to increase the yield of grease.

The Character of the Garbage. The garbage as received at the plant varies in kind, amount and weight with the season, although the seasonal variation is not so great as it is in New York, where the summer garbage is said to be twice the amount of the winter garbage. The winter garbage in Boston is richer and heavier, bulk for bulk, than the summer garbage, although the total amount is less. A weekly variation is also noticed; thus on Saturdays, fish is abundant and on Monday and Tuesday, meat. The average weight of a cubic foot of garbage is stated to be about forty-five pounds (deputy superintendent

garbage plant), or fifty-four pounds (56 cubic feet weigh 1½ tons, superintendent sanitary division, 1900). (Sanitary Division report, 1898, states weight of 56 cubic feet to be 1¼ tons as a maximum at certain seasons of the year. This would agree more nearly with the Garbage Company's statement).

The garbage is said to contain generally 7 to 10 per cent. of material not garbage, although the regulations read that garbage must be kept separate from all other refuse except food cans and food bottles. The company's officers estimate that from 140 to 150 tons per day are received and treated. The Sanitary Division records show for 1900 that 50,450 loads of offal were delivered, or an average per working day of 240 to 250 tons, at 1½ tons to a load or about 200 tons at 1¼ tons to a load. This yields about 2 per cent. grease and 10 to 12 per cent. tankage. The garbage is taken from families once a week in winter, twice in summer; from restaurants every day. It is stated, however, that much valuable matter is lost in hot weather by the decomposition and the deliquescence of the garbage on the scows, running out through the scuppers at the dump and in transit to the plant. The value of the grease fluctuates widely, but is stated to average 2 to 2½ cents per pound.

The tankage, used as fuel, to the amount of 35 to 40 tons per day, is said to replace about five tons of coal and must therefore be worth about 50 cents per ton as fuel.

REFUSE DISPOSAL IN THE DISTRICT OF COLUMBIA.

By WILLIAM C. WOODWARD, M. D., L. L. M.,
Health Officer, District of Columbia.

The generally unsettled state of the refuse disposal problem has been well illustrated in the history of the city of Washington with respect to this feature of its municipal life during the past ten years. From a loosely-drawn contract providing only for the collection and disposal of swill and dead animals, fixing but vaguely the duties of the contractor, giving what was probably inadequate compensation for the work, and binding the city to the performance of certain acts which it had no authority to perform, the District of Columbia has through a process of evolution reached a stage where its refuse disposal contract provides for the collection and disposal of all forms of waste except stable manure, where the obligations of the contractor are clearly defined and easily enforced, where he is adequately compensated, and where the city is ready and able to perform every obligation which it has undertaken.

Ten years ago swill was collected in wooden barrels, placed on goose-neck wagons, from receptacles whose character and location were determined only by the intelligence or caprice of individual householders and without reference to the convenience of the city's agent for the collection of such material. The records of the service during and before this period are incomplete, but it is certain that from various causes the collection of garbage was irregular, uncertain, and generally unsatisfactory. To undertake to analyze these causes is not now of interest. The contract which had involved such poor service was annulled by the city for alleged breach of its requirements by the contractor and the work undertaken, in the emergency arising from such abrogation, by the municipality through its own employes. That the service under this system was more efficient is not open to doubt. That its cost, however, was much greater than the amount that had been paid the contractor is clearly beyond question, and that the service thus obtained could have been given by him for such increased compensation is possible. The increased cost was presumably entailed as the result of the contractor's default and was charged against him and his bondsmen; if he had undertaken to do more for a given sum than was possible for him to do, that was his misfortune for which he and his bondsmen in the theory of law justly should suffer. Suit was entered against the supposed responsible parties, but never has been and probably never will be settled.

In the summer of 1891, following the abrogation of this early contract and the performance of the work by the community, came a period which, in the beginning at least, gave promise of better things. Householders were to keep their garbage in water-tight receptacles at places on their premises convenient to the collectors. The service to be performed by the contractor was clearly specified; collections were to be made daily, tri-weekly, and semi-weekly, as the circumstances seemed to require. Dead animals were to be collected daily. The material collected was to be transported beyond the limits of the District of Columbia, but once beyond such limits the contractor was free to dispose of it as he saw fit. In theory at least it was dumped on farms along the lower Potomac and there used as a fertilizer. For the service thus rendered the contractor was to receive $29,400 per annum.

On July 14, 1892, a special appropriation of $2500 per annum was made to enable the Commissioners to secure the removal of all garbage in "enclosed tanks," and its "immediate destruction." A contract was made for disposal by the reduction process, and a plant for this purpose was erected in one of the more sparsely settled and remote sections of the city and put into operation. Complaints from those living in the neighborhood were many and bitter. As the writer was not then connected with the Health Department, he is unable to speak definitely as to the character of this establishment, but judging from its remains, as seen some time after its destruction by fire, such complaints were probably well founded. But in the midst of the controversy which centered about the complaints of citizens and to which the municipality itself and the contractor may be said to have been parties, the entire problem was settled, temporarily at least, by the destruction of the reduction plant by fire. No attempt was ever made to rebuild it and the contracting company soon went into the hands of receivers. The receivers conducted the business for a short time, but one of them soon purchased the interests of the defunct company. The service rendered had been, and continued to be, extremely unsatisfactory, due largely to the facts that the contract was not a profitable one for the contractor; that the District had undertaken to have the garbage placed in a specified kind of receptacle in accessible parts of the premises, but had no legal authority to bring this about; that the contractor would be put to additional expense to attempt to collect without the enforcement by the District of this part of its obligation; and that there was no prompt and certain way of enforcing the contract by means of fines or through any provision of the contract whereby the Commissioners might remedy neglect and charge the cost of so doing against the contractor. The situation was bad, but the way out did not seem clear. Experience had taught the city that the abroga-

tion of the garbage contract was not to be lightly thought of, and that, even if the contract should be abrogated, there was not much likelihood that the increase in the cost of the service could be recovered from the contractor or his bondsmen because the District had been unable to fulfill its part of the undertaking, viz., to have the material to be collected placed in suitable receptacles and in suitable places. Relief finally came, March 2, 1895, in the way of legislative authority for the making of a new contract upon the termination of the existing one by mutual consent or otherwise. An ample appropriation for the new contract (sixty thousand dollars per annum) was provided by the same act, but as it became available only on the termination of the existing contract, an arrangement was readily made with the contractor having the then current contract for surrendering his rights.

Experience had proved a good teacher. The legislation authorizing a new contract was so framed as to confer upon the District specifically the right to make necessary regulations for the collection and disposal of garbage and to annex to such regulations such penalties as would secure the enforcement thereof. It carried, too, what seemed to be an ample appropriation for the work. Specifications were drawn and proposals invited and received. The essential differences between the resulting contract and those preceding were practically these: First, that for each well-founded complaint of neglect by the contractor of any of the requirements of the contract, a fine might be imposed; second, that if on account of any disregard of the specifications on the part of the contractor extra inspectors should be required, they might be employed by the Commissioners in such number as they saw fit and the cost of their services be charged against the contractor; and third, that if the contractor failed to remove any dead animals or garbage within a specified time after notice, such animals or garbage might be removed and the cost thereof charged against the contractor. The specifications had made no definite provision for the method of disposing of garbage and dead animals, but permitted each bidder to submit his own scheme. The resulting contract provided that they should be incinerated. The cost of the entire service was $57,000 thousand dollars per annum. The contract provided for the collection of garbage within the city of Washington daily during the summer months, and twice per week during winter, and in the suburbs, three times per week during the summer months and twice a week during winter. The particular method of disposal submitted by the contractor was the Dixon furnace, but he offered to install any other furnace satisfactory to the Commissioners. After a careful study of the various systems of garbage disposal then in use,

arrangements were entered into whereby the contractor installed a Brown furnace, being the system selected by him, and a Smith furnace, being the system selected by the Commissioners of the District. It was designed that each plant should be of sufficient capacity to destroy the city's entire output of garbage and dead animals under any circumstances whatsoever, so that if either furnace required repairs or was for any other reason out of use there would be no trouble in disposing of the putrescible refuse of the city. Much difficulty was experienced in finding sites for these establishments. Citizens of every locality felt that their swill should be disposed of in their neighbor's domain, but not in their own. This difficulty having been adjusted, however, the furnaces were duly erected. Upon trial it was found that the Brown furnace was capable of destroying a reasonable amount of garbage without nuisance if properly operated, but that its actual capacity was far below that which had been estimated, and attempts to crowd it resulted in widely-distributed odors. I have no doubt that it did its work at a reasonable cost, although not at such cost as the contractor alleged under circumstances which will be referred to later. The ashes had a certain though inconsiderable market value. In constructing the Smith furnace an attempt was made to do away with a most objectionable feature in previous construction, viz., the leaking of water from around the lower doors. Whether from changes incident to this attempted improvement or from some other cause, the furnace built in Washington was not a success. It ran for a time on trial, but gave rise to so much complaint, based on odors emitted from it, that, although it had been selected by the Commissioners in the first instance, it was never accepted by them and never went regularly into service. Moreover, during its experimental runs it never even approximated its estimated capacity.

The Smith furnace having been rejected as unsatisfactory and the Brown furnace failing to destroy more than 40 or 50 per cent. of the daily output of the city during the summer months, the garbage problem again confronted the community. Experience in locating garbage crematories within the city had demonstrated the difficulty of doing so; the fact that the Smith furnace which had failed had been specifically designated by the Commissioners as the one to be erected involved a nice question as to the right of the Commissioners to require the contractor to build another furnace to replace it; and it seemed to be scarcely worth while to have 40 per cent. of the garbage burned and the remainder towed down the river to be disposed of on farms along the shores. The contract was, therefore, modified so as to authorize the contractor to carry all of the garbage and dead animals of the city down the river on scows and to dispose of them in the

same primitive manner which had been followed under the preceding cheaper contract. For such service the contractor was paid the same amount that he would have been paid for burning it. In support of his claim for compensation at that rate he produced figures, satisfactory to himself and to some of the municipal officers charged with the adjustment of such matters, which proved that he could burn garbage in the Brown furnace as cheaply as he could haul it down the river on scows and dispose of it there.

Matters drifted along under the same conditions until June, 1900. The Health Department had long before urged the necessity of establishing a service for the collection of ashes. This recommendation had been pushed from time to time, but without effect. About 1899 the Superintendent of the Street Sweeping Office joined in the recommendation and with the approaching termination of the then current garbage contract a renewed effort was made to extend the service. The Superintendent of the Street Sweeping Office endeavored to have the collection of ashes made a part of the street sweeping service. The Health Department, however, took the position that ashes were the least objectionable of all city refuse; that before provision was made for the collection of ashes the city should undertake to collect the contents of box privies and miscellaneous house refuse. The Department urged, however, the establishment of a general scavenger service to include the collection of all forms of waste—garbage, dead animals, night soil, miscellaneous house refuse, and ashes—for such parts of the District as the nature of the service might require. It based its recommendation for such a service on the difficulties the Department had encountered in endeavoring to keep the city clean; especially on the fact that objectionable refuse was deposited in improper places because it was cheaper for the householder or the cart man to do so than to dispose of it properly, and because it was impossible for a policeman to be present on every vacant lot at every hour of the day and night in order to prevent the practice. Adopting the recommendations of the Health Department, the Commissioners invited bids for the collection and disposal of garbage, dead animals, night soil, miscellaneous refuse, and ashes, under certain fixed regulations, for a period of five years. Proposals were received from various responsible parties, the lowest and best being from a gentleman who had had experience in the business and who offered to do the entire work for $115,000 per annum. An effort was made to secure authority to enter into the contract with this individual for such work at the price named. Congress, however, refused to au-

thorize such a contract, and on June 6, 1900, required the preparation of new specifications and a new bidding.

When the new proposals were received, the Commissioners of the District awarded separate contracts for the collection and disposal of various items of waste, as follows:

A contract for the collection and disposal of garbage and dead animals for five years for $51,600 per annum, with a minimum additional compensation of $1000 per annum for any extension of the service whatsoever, and with a deduction of fifty cents per ton for each ton in excess of twenty thousand collected during the year.

A contract for the collection and disposal of ashes for five years for $29,979 per annum.

A contract for the collection and disposal of miscellaneous refuse for five years for $8000 per annum.

A contract for the collection and disposal of night soil for five years for $17,000 per annum.

The figures represent an expenditure per capita per annum of approximately seventeen and three-tenths cents for garbage and dead animals, ten cents for ashes, two and seven-tenths cents for miscellaneous refuse, and five and seven-tenths cents for night soil. As it has been impossible to obtain from the Superintendent of the Street Sweeping Office, who is now charged with the enforcement of these contracts, information as to the amount of these materials collected during the past year, no statement can be made as to the cost of collecting and disposing of these various materials, per ton, per load, or per barrel, under the present contract, nor as to the amount per capita per annum collected. The following statement showing the amount of garbage and night soil, and the number of dead animals collected and disposed of during ten preceding years, and the cost of the service may be of interest:

OFFAL REMOVED AND DISPOSED OF DURING TEN YEARS ENDED JUNE 30, 1900.

Year.	Population.	Dead Animals. Number.	Garbage. Tons.	Night Soil. Barrels.	Contract Price, Garbage and Dead Animals Only.	Remarks.
1890–91	242,500	9,910	24,683	19,671	$22,000	Deficiency approated $18,239.83.
1891–92	253,010	10,528	22,039	18,640	24,000	With $2,500 additional, for "removal in steel tanks and immediate destruction."
1892–93	260,800	9,649	14,814	15,725	24,400	Fifty cents a ton extra for "removal in steel carts and immediate destruction."
1893–94	265,000	10,340	14,172	11,284	29,400	Deficiency appropriation $2,000.
1894–95	270,514	7,512	23,227⅜	9,720	29,400	
1895–96	274,160	7,712	17,270¼	11,300	57,000	
1896–97	276,963	7,161	18,928⅝	7,759	57,000	
1897–98	278,001	10,129	23,167	7,416	57,000	
1898–99	278,289	8,162	20,946	6,497	57,000	
1899–1900	278,577	12,170	24,339	6,157	57,000	

The contract for the collection and disposal of garbage and dead animals, which was awarded to the Washington Fertilizer Company, went into effect on August 1, 1901, and is the contract under which the work is now being done. Under it garbage is collected in steel-bodied wagons, so arranged that the bodies when filled can be lifted from the running gear by means of hoisting apparatus and placed on flat cars specially constructed for their accommodation. Dead animals are collected in wagons similar to those generally used for that purpose. The car in which they are shipped is an ordinary freight car, the floor and a part of the sides of which are covered with a metal so as to prevent absorption and to promote easy cleansing. All cars are removed from the siding and taken to the disposal plant as soon as practicable after being loaded. The entire transfer from the wagons to the cars is, under normal conditions, effected without nuisance.

All garbage and dead animals collected are disposed of by the reduction process at a point about thirty miles, by railroad, from the city. As the establishment is located on the Potomac river, transportation by boat is possible, though hardly practicable under existing conditions. The reduction plant is modern, but it contains nothing particularly new. The material collected is placed in digesting tanks, subjected to steam under pressure, the liquid portions drawn off, and the tankage compressed within the digestor by steam by means of special apparatus. The cooked mass is compressed further by hydraulic pressure after removal from the digesting tanks. All liquids drawn off are allowed to settle, the grease saved, and the residue discharged into the river. The tankage is dried, ground, screened, and placed in sacks for shipment. The characteristic feature of this establishment is the method of preventing nuisance, which is accomplished simply by locating the plant at a point so remote from habitations of persons not interested in it as to diminish or absolutely to avoid complaint. As the prevention of complaint from residents in the vicinity is always a matter of considerable expense in the cost of operating a reduction plant, it might seem at a first glance as though this were the ideal solution. It remains to be seen, however, whether the increased cost of transportation does not more than offset the cost of operating such an establishment in a more or less sanitary manner nearer the point of collection. When it is remembered, too, that a very large percentage of the material collected is water, it would seem as though some means should be found whereby the garbage could be relieved of this worthless element at the point of collection, even if it be necessary to transport the dried residue away from the city for the purpose of extracting the grease and preparing the tankage for the market.

The collection of dead animals extends to every part of the District of Columbia, an area of about sixty-four square miles, and is made daily, including Sunday, during the entire year. They are carried out of the city along with the garbage, and disposed of at the reduction plant just referred to.

Until recently a certain amount of garbage and a considerable number of the larger dead animals were collected by what were known as private collectors. The garbage collectors were granted permits on the application of the householders desiring their services and upon providing facilities for collecting and transporting the material without nuisance. Nearly all of the material collected was taken beyond the limits of the District of Columbia and there fed to swine. The men engaged in the service were usually poor colored farmers, and the swine thus fed were raised for domestic consumption. Their services were desired by householders in many cases because of the impracti-

cability of keeping the material on their premises accessible as required by the city's contractor, the private collectors being willing to move it from any place, however inconvenient. In other cases the garbage was given to private collectors because they were willing to remove other refuse along with it, to clean the yard or the woodshed, or to render any other slight service. Collectors removing garbage from hotels sometimes paid the hotel for the material collected. There was but a single party, other than the contractor, engaged in the collection of dead animals. He, the proprietor of a reduction establishment on the Potomac river, purchased carcasses of horses from the owners thereof and carried them to his establishment where they were utilized in the usual manner. Since the present contract has been in effect permits are no longer issued to private collectors of garbage and a special permit is needed by collectors of dead animals for each animal removed. Most of the men engaged in such work, being without means, have acquiesced to the new order of things. The collector of dead animals, however, has continued to collect such material without reference to authority or permit and, as a consequence, has been duly arrested and tried in the police court. The facts being admitted he was, of course, convicted, but an appeal was taken to determine the validity of the law. On his behalf it is maintained that no regulation is valid which undertakes to prevent the collection and transportation of refuse food of any sort or of dead animals, when such food or carcasses do not in fact constitute nuisances and so long as the collection and transportation of such material can be easily regulated without being forbidden. If, for instance, a dead horse is worth a dollar and can be removed without nuisance or danger to public health, it is immaterial, from a legal standpoint, whether the municipality undertakes to deprive the owner of his dead horse or of his dollar. The same principle applies even to the smallest quantity of garbage; if in return for my garbage I can receive services worth even a single cent, the government has no more right to rob me of my garbage than it has to rob me of my cent. In any case it is taking property without due process of law. The outcome of prosecutions under existing regulations, involving as they do a general principle, may be looked forward to with considerable interest.

Ashes and miscellaneous refuse are collected in wagons with large wooden bodies, the bodies being covered with canvas when filled. Such collections are made weekly and extend to the city of Washington and its more densely populated suburbs. Under the term "ashes" the contract includes practically all non-combustible refuse. The material collected is taken to low places, designated as public dumps and under the immediate supervision of a dump master. Theoretically all

combustible material is incinerated in the Brown crematory, which was used for the destruction of garbage, but abandoned because of insufficient capacity. Practically a considerable quantity of it finds its way to the dumps and there creates nuisances.

Night soil is collected by the pneumatic process. The public collection of this material extends to every part of the District. The material collected is carried in air-tight barrels on scows to land lying on the Potomac river some miles below the city, and there emptied into pits.

From the foregoing statement it will be seen that the District of Columbia provides for the collection and disposal, without direct expense to the individual householders, of all forms of refuse with a single exception, and that is, stable manure. Material of this sort is a common source of nuisance and with the growth of the city its disposal through individual effort becomes more difficult. It is particularly objectionable as it forms a breeding place for the domestic fly, a creature now believed to be, under certain conditions at least, an important agent in the dissemination of infective diseases. While no action has been taken towards preventing or limiting this nuisance, by means of a public service for the collection of such material, the time will soon come when the storing of it in and about the stable and its removal will be as carefully regulated and provided for as are the storing and removal of garbage and of human excreta.

THE BACTERIAL PURIFICATION OF WATER BY FREEZING.

By H. W. CLARK, Boston, Mass.,

Chemist of the State Board of Health of Massachusetts.

The question of the purity of an ice supply harvested from a polluted water is one that has given many persons much uneasiness of mind and many misgivings as to the safety of using it. It is a question that is often referred to state boards of health by local boards and also by individuals and, in order that the question might be satisfactorily answered by the State Board of Health of Massachusetts, not only to the inquirers but also to the Board itself, an investigation upon the purification of water by freezing has been made during the past two winters and I have thought that a summary of this investigation might be of interest to this Association.

The subject had, of course, been investigated before by the Board, but additional knowledge seemed desirable.

The chemical and bacterial examination of a cake of ice shipped to a laboratory, while satisfactory to the analyst as showing with considerable definiteness the character of this particular cake, has seemed to mean but little at times when considering the ice supply as a whole from which the cake was taken, and the method in which it is harvested. A report, showing this cake to be of an entirely satisfactory quality and therefore the ice safe to use, is often exactly opposed to the opinion of the collector of the cake, who has examined the source of the ice supply in question and detected numerous chances of pollution, even although this collector may know perfectly well that bacterial and chemical purification of water occurs during freezing. Just how great this purification is, under the varying conditions that must obtain in different ponds and rivers containing water of a varying quality, has not been definitely known by us; neither has the difference in purification that occurs with ice formed in quiet water compared with ice formed in water moving with different degrees of rapidity.

In the winter of 1899-1900 we made a few experiments in regard to the retention of bacteria in ice during the freezing of water and the length of life of the bacteria under these conditions. In this work the experiments were so conducted that all the water in a pail or small tank was frozen. This is not the manner in which ice is formed upon our natural ice supplies, although much artificial ice is formed in this manner; this ice, however, being generally found from what is sup-

posed to be a very pure water. In these first experiments we used a polluted river water and also sewage, and found, as was expected, that, while when freezing all the water a very large proportion of the bacteria in the water frozen were killed in the process of freezing, still a very large number were left in the ice and lived for a number of weeks. Other experiments made in that winter showed what is, of course, well known that, when ice is formed naturally,—that is, in the usual manner on the surface of a considerable body of still water,—most of the bacteria are expelled from the water frozen and remain in the water below the ice, and but a comparatively small number are retained in the ice. For instance, two of the experiments that were made were as follows:

Merrimack River water, containing 7,100 bacteria per cubic centimeter and 17 B. coli per cubic centimeter, was frozen and the ice formed contained about 5 per cent. of the total number of bacteria in this water, and no colonies of the colon bacillus could be found. Sewage containing 500,000 bacteria per cubic centimeter and 4,100 B. coli per cubic centimeter was likewise frozen, and the ice formed from this sewage contained about 1 per cent. of the bacteria of the sewage, but no colonies of the colon bacillus could be found. In these experiments the liquids were frozen in tanks containing only a slight depth of water below the ice formed.

During the winter of 1900-1901 the investigation was continued and very many experiments were made, in which volumes of water of varying degrees of purity were exposed in tanks six feet deep and twenty-eight inches in diameter, and the ice formed upon these tanks carefully examined. In all of this experimental work it was found that from 95 to 99 per cent. of the total numbers of bacteria in the waters experimented with were eliminated from the water during freezing or killed before the examination of the sample, and that, whenever a water not more polluted than the Merrimack River water at Lawrence, into which, however, the unpurified sewage of a number of cities flows, was frozen in these tanks, every colon bacillus was, judging from our examinations, killed or excluded from the ice formed.

Besides these experiments in the tanks, a number of samples of ice for chemical and bacterial examination were taken as it formed upon running water such as the polluted Merrimack River, and from still water, also polluted to a greater or less extent; samples of water being collected also, wherever samples of ice were collected. Twice during the winter a series of samples of ice and water was collected from the river at different points above Lawrence and between Lawrence and Lowell, and examined both chemically and bacterially; these samples being collected at distances varying from three to eight and one-half

miles below the outlets of the sewers of Lowell—Lowell being a city of 90,000 inhabitants and emptying all of its sewage into this river. Examination of all these ice samples showed that, while the average number of bacteria in the river water, collected at the same locations from which our ice samples were taken, was 4,100 per cubic centimeter, the average number of bacteria in the ice was nine per cubic centimeter, showing an elimination of 99.78 per cent. The average number of B. coli in the river water was one hundred and twenty per cubic centimeter, and this germ was not found in any of the ice samples examined. That is to say, the number of bacteria found in the ice formed upon the river was less than the number in the ice formed from the same river water in our experimental tanks. The river ice, however, had been formed for a number of weeks before collection and examination, while the tank ice was examined within a few hours of forming. This probably accounts for whatever difference there was in number of bacteria found, as the river ice had probably been formed long enough for many bacteria, at first retained in it, to die.

We have at Lawrence a large water power and canals by which the river water is distributed to the various mills. In these canals the water is flowing at a much greater rapidity than the water in the river above Lawrence, and a number of samples of ice formed upon this swiftly-moving river water were also collected during the past winter and examined for the presence of bacteria. It was noticed that the elimination of total numbers of bacteria in the ice formed under these conditions was not nearly as great as in ice formed under the conditions in the river, where the water was moving much more slowly, and about 35 per cent. of the samples of ice collected from the canal that were examined contained colonies of the colon bacillus.

A large number of samples of ice and water from other ponds and rivers, upon which the ice was formed under varying conditions, were obtained, and in general the same results were found as in our experiments with water frozen in our tanks and with the ice and water collected from the Merrimack River.

The power that water has of purifying itself chemically by its transformation into crystals of ice is, of course, well known and is characteristic of crystallization. Studying the chemical analyses that we have made of samples of water and the ice formed from this water, we find that not only is a considerable percentage of the bodies in suspension in the water prevented from becoming embodied in the ice crystals formed, but also what at first glance appears more remarkable, a larger percentage of the bodies in solution is thus prevented. Free ammonia, chlorides and the mineral salts that cause hardness are all partially or entirely driven from the water frozen into the water remaining un-

frozen. Furthermore, it is evident that a substance such as ice, which in forming can free itself from the bodies in solution in it in its previous state, must have enormous power to prevent bacteria,—that is, bodies of a tangible size in suspension,—from becoming entangled within it, if there is a considerable depth of water under the ice forming and if these bacteria do not have a tendency to rise. We found that not in one instance of the still freezing of ordinary polluted water in our tanks or still water in the ponds examined were we able to find B. coli in the ice formed. When freezing Merrimack River water in tanks, the average number of bacteria of all kinds retained in the ice, taking all our experiments into consideration, has been considerably less than 2 per cent. of the number in the water, and it will be noticed that the number of bacteria found in the samples of ice collected directly from the river was only .22 of one per cent. of the number in the river water. That is, the water by freezing purified itself bacterially as well as could be expected by an efficient sand filter filtering this water.

When we froze sewage in our tanks or Merrimack River water made more polluted by the addition of 5 per cent. by volume of sewage, we invariably found the colon bacillus in the ice formed; that is, in these experiments we had exceeded the limits of bacterial and organic pollution which the ice as it formed from water and crystallized could overcome. We also found that when ice was formed on swiftly-running water as polluted as that flowing in the Merrimack River, where sedimentation was overcome to a certain extent and there was a constant lateral or rolling movement of all matter in suspension in the water, together with a tendency to prevent perfect crystallization because of this rolling movement, the danger of the retention of bacteria in the ice was much greater, this being shown by our examination of the samples of ice formed upon the swiftly-running water in the canal.

It was evident from all our experiments, finally, that, if ice is not to contain any considerable number of bacteria, it must be formed in such a place that all of the water is not frozen, and the deeper and quieter the water under the layer of ice when forming, the less chance is there of bacteria being retained in the ice; this applying to ice formed upon both rivers and ponds. When, in order to thicken ice, the ice already formed upon a pond or river is flooded and the entire volume of water upon the ice is frozen, bacteria will undoubtedly be retained in this ice, just the same as when the total volume of water in our pails was frozen, as described in the beginning of the paper; this making it evident that the top ice should be planed and removed before cutting and storing, and this is quite generally done in harvesting most of the large ice supplies in Massachusetts.

On the whole, it is evident that the conditions surrounding water when it freezes are very important factors in determining the purity of the ice formed; but it must be said that, as far as we can find, there is only one known case on record where it is apparently absolutely assured that sickness was caused by polluted ice. A large proportion of the inhabitants of the city of Lawrence are supplied with ice harvested from the very polluted Merrimack River water and yet, since the construction of the sand filter by the city several years ago and the filtration of its public water supply, the typhoid fever rate has been made one of the lowest in the State of Massachusetts; and it must also be said that in former years, before the construction of this filter when epidemics of typhoid fever were common in Lawrence, these epidemics almost invariably occurred in the winter months, rather than in the summer months, when the consumption of ice is the greatest.

REPORT OF THE COMMITTEE ON THE RELATION OF FORESTRY TO THE PUBLIC HEALTH.

By Prof. WILLIAM H. BREWER, Chairman,
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That forests are intimately related to the public health is so universally conceded that the fact needs no argument here.

Exact investigations on the subject are curiously few, and the committee is not aware that any systematic presentation of the whole subject has yet been made, in the light thrown upon it by scientific research. Ebermayer of Munich has discussed portions of the subject from original research as well as compilation in his "*Hygienische Bedeutung des Waldes*," Vienna, 1890, but his paper does not touch at all on some of the points of greatest interest to us, and moreover, both the conditions and the problems involved are very different in Europe from what they are in America. The committee therefore wishes to present a statement of the chief points of interest as they now are in the portion of North America we represent, to the end that this Association, both by the individual zeal of its members and possibly by its action as a whole, may aid in extending our specific knowledge of the subject, and in promoting this factor in practical sanitation.

In this report the committee confines itself to forests and forestry in the countries represented by this Association, namely, Mexico, the United States and Canada. This geographic region is so vast in extent, it includes such a variety of climate, soil and topography, that the relations of forests and forestry to the public health are very unlike in different portions of it. Some of the questions involved are local and others general, but for our present purpose these several relations may be classified into two main divisions or classes, namely, the relations of forests to the health of communities as communities, and the relations of forests to the health of individuals as individuals.

A community dependent on a forested watershed for its water supply is an illustration of the first, and the people most concerned may be distant from the district on which the rains fall. In this case the forest benefit comes to the community specially benefited. An individual may visit a forest for recuperation or cure, or he may choose his dwelling near it for its more salubrious air, or a similar place be chosen as a site for hospitals and sanatoria for the same reasons. These are illustrations of the second, and in these cases the individual must go to the forest to be directly benefited by it.

The immediate subject presented to this committee is "The Relation of *Forestry* to the Public Health." We assume that this includes a consideration of what the relations really are of the forests themselves to health.

Forestry is the art which concerns itself with the care, the maintenance, the economical utilization and the preservation of forests; how forests may be protected in their life and existence, how promoted as to their luxuriance of growth, how the crops of wood or other products may be harvested to the best profit, and at the same time the forests themselves be preserved for permanent use. Heretofore the rule in this country has too often been to destroy the forest by the using of it. In this report we will use the word "forest" in the sense of woodland, a tract of land with its permanent covering of trees or shrubs.

In the public mind, forestry is widely misunderstood. It is too often looked upon as if it was strictly analogous to agriculture, and as if it were a branch of that industry.

In this discussion we consider it especially important that the differences be kept in mind that we may the clearer see how to direct our efforts that they may do the most good. Agriculture, our other great rural interest, began with the settlement of the country and all of us are therefore more or less familiar with its principles and methods. Forestry in its best sense is new to us and probably this is the reason why so many misunderstand both its principles and methods.

In some respects these two arts are very like, in others very unlike, even when interdependent. Forestry like agriculture is an art, and in both, we must apply the knowledge gained from the sciences if we wish for the highest practical success. Hence either subject may be studied as a science by those not practicing the art. There is a science of forestry which the members of this Association may study with profit.

The art of forestry is like the art of agriculture, in that it may be successfully practiced by the small landholder. It is very unlike agriculture, in that it is of more general importance to the country at large, and especially of much greater importance to the public health, when it is conducted on a large scale and on great continuous tracts of public land owned by the municipality, the state or the nation, and its management conducted as a branch of the public service. This fact is so very important when we consider the relations of forestry to the public health, that the stronger to emphasize it, I will consider the subject more fully.

Agriculture is solely concerned in the production of cultivated crops and of domestic animals. Its problems are entirely local. As a rule its most successful practice is by private land owners on holdings of

moderate size. Moreover, its methods and its products may be changed from year to year. It may be suddenly abandoned at any place, should circumstances demand it, and almost as suddenly be resumed when the circumstances are again favorable. Contiguous farms may be successfully conducted along very unlike lines, growing different products, and by different methods. But forests must be more permanent. Trees are the longest lived of living things, and require the longest time of any crop to grow. The very idea of a forest is associated with permanence, and its most important use may be not at all local. An obvious phase of this fact is seen in the relation of forests to the conservation of water for the supply of distant cities or for the navigation of distant rivers. Its greatest relations to the public welfare are not local. In our own country, they are wider than the states themselves, and in places become matters of such geographic extent that only the nation can successfully handle them. New York City should own and manage the forested watershed of Croton river, the main source of its water; New York State, its Adirondack forests for the maintenance of its navigable canals and rivers; and the nation, certain of its great western forests where the interests of two or more states are often involved.

The physical factors involved in the relation of forests to health are Forest Water, Forest Soil, Forest Air and Forest Climate. These cannot be fully discussed as independent factors, because all are closely correlated, and more or less interdependent, and moreover, they all work in combination in most of their hygienic relations.

Forests rarely occur where the annual rainfall is less than ten inches, and a considerable more than this is required for a luxuriant growth. But, if the climate is warm enough, no rainfall is great enough to prevent forest growth. Localities in India have luxuriant forests where the greatest recorded rainfall in the world occurs, 600 inches per year being common, and over 800 inches have been recorded in exceptionally rainy years.

Forest Water. The chief relations of forests to water, are, firstly, that forests conserve the rainfall. This is perhaps its most important relation to the public health in the countries here under consideration. Secondly, forest waters, as a rule are purer than the waters of the open country. These are the greater relations. It is probable, however, that forests slightly increase the rainfall, but if so, the relative amount is not enough larger to be an important factor.

Forest waters are *purer* than those from tilled lands. The dissolved impurities of natural water are derived from the decaying organic matter on or near the surface, and from the solution of certain portions of mineral matter from the soil. It is obvious that the organic impuri-

ties would be more abundant in waters flowing from cultivated fields. Forest soils are so little disturbed that the constituents change less rapidly than in tilled soils, where the stirring, mixing, and manuring promote chemical changes in the mineral matter which increases its solubility.

Forest waters are also, as a rule, *clearer and cleaner*. They contain less suspended matter which produce turbidity and also much less bacterial life. The hygienic importance of these characters are obvious.

Forests, always and everywhere, conserve the rainfall and regulate the flow of springs and streams better than the open country does. The practical applications of this fact will increase in hygienic importance with the increase in size of our cities and in the number of towns requiring a public supply of water. The economic importance, as related to agriculture, we will not discuss here, although its intimate relation to the food supply of many of our states, makes it indirectly an important hygienic factor.

Forest streams always have a steadier flow than those from an open country. The floods are restrained and are neither so sudden nor so violent, the high water is more prolonged in its decline and in times of drought the streams do not become so low. Therefore they make the surplus rainfall more available for the use of mankind and the welfare of his crops and his animals. We need not here enter into the well-known elementary details of the process. It is enough for us to say that it is a law of nature that a covering of living plants, clothing the ground, preserves the soil from washing away from the hillsides and regulates the flow of springs and streams. Whether the green mantle be a forest of trees, a chaparral of shrubs, or a turf of grass, it performs this all important office. In each case, the vegetation preserves the soil and conserves the waters falling upon it. The leaves and stems of the plants hinder the rain and snow from running off or flowing off, the roots bind the soil and keep it in place and by their decay impart to it a texture and condition which promotes the absorption of the water into its substance, and the shade retards evaporation. This is the great function of the mantle of verdure with which nature beautifies the landscape and protects the hills in its folds and the valleys in its creases.

Turf, chaparral and forest differ in the degree and magnitude of their work, but each, according to its nature and its opportunity, performs this same beneficent function. The precious water is prudently saved in times of abundance and charitably given out in times of drouth and thirst.

Chaparral. In climates so dry or so uncertain that the woody growth is stunted or reduced to chaparral, the function of water con-

servation is reduced, but not obliterated. Chaparral preserves the soil from being washed away, and in that way serves in saving the water.

In a region having a scanty rainfall, the amount varying greatly in different years, and with the watershed entirely or in part covered with grassy slopes, which become very dry every summer, and yet might be induced to grow small trees, the relations of trees to water conservation are less understood.

Whether increasing the tree growth on such a watershed would so increase the waters in exceptionally dry years, that the available amount would be greater, is as yet an unsolved problem. We are left entirely to conjecture. Certain European investigators have learned that the transpiration of moisture from the leaves of the trees would more than offset the saving due to the shading of the ground and the better retention of the water in the soil. The National Academy Forest Commission of 1896 had this problem presented to it, but could make no satisfactory answer. Specific investigation and exact data are lacking, but it is an important problem for some of the cities of California and those other western regions where there is a great range of yearly rainfall, and sometimes periods of several dry years in succession.

The height of the ground water, and the moisture of the upper layers of the soil, are hygienic factors, so important and varied that they have been overrated by many sanitarians, notably by the eminent Professor Pettenkofer. Space forbids a full discussion of this complicated subject in its forest relations. It may, however, be stated as a general fact, that the average level of the ground water is greater in forests than in the open country, its fluctuations are less and that this is a matter closely related to the public health, especially in country districts depending on wells for water.

Wet soils have in some places been made much drier and healthier by being planted with trees, especially with certain species of Eucalyptus. The kinds used are of rapid growth, and transpire so much water that the soils are made drier. It is, however, possible that with trees of this genus, the aromatic exhalations of the trees may be a factor in producing the hygienic results reported to have been achieved. Their planting and growth has reduced malaria in various parts of the world. In Cuba they are reputed to drive away mosquitoes, but in Mexico this is denied.

Forest soils differ from the soils of fields and treeless regions in several characters. There has been much investigation of this subject, in the interest of both agriculture and forestry. For our present purpose, it is enough to say that forest soil, not being stirred except as is done by the roots of plants, it is not subject to that rapidity of chemical

change that occurs in lands subjected to tillage, by which fresh portions are successively brought to the immediate action of the air. Forest soils are very much poorer in bacterial life as to quantity, and unlike as to prevailing species. They are usually protected by a covering of leaves in various stages of decay and the organic matter in the soil itself is relatively much more concentrated in the uppermost layer. In cold climates it does not freeze so deeply in winter nor get so warm in summer, nor is it subject to as great daily fluctuations of surface temperature as occurs on open ground. These affect the chemical changes that go on in the soil and on its surface, and all taken together have some hygienic influence. Precisely how much, or in what way is not specifically shown, and are matters of speculation and inference rather than of demonstration or proof. (See, for forest soils, "*Forschungenen auf dem Gebiete der Agriculturphysic*, Vol. IX, part 3d.)

Forest Air. Important as the relation of the air is to health much greater importance was formerly attached to it than now. It was once considered to be the chief vehicle for the spread of many epidemics and pestilences, and was often believed to be the immediate cause of them. Many terms in medicine are survivals of these old beliefs, of which "malaria" is perhaps the most familiar. There is a large literature relating to this, curious to the modern student of science. With the growth of exact knowledge, the relations are known to be no less real, although not so startling.

Forest air has been much talked about and written about. That many invalids are improved by it, there is no question; so are invalids often benefited by sea air and mountain air, which in many characteristics it resembles. That forest air is usually salubrious, and often even curative, is well known. There have been some considerable specific and exact investigations made as to its actual peculiarities, some of the investigations being incident to general investigations on the atmosphere respecting its composition and contents, and others directed especially to this end in forestry experiment stations in several European countries. Many thousands of chemical analyses have been made showing very particularly the relative properties of oxygen, carbonic acid and ozone, and there have been numerous investigations on the amount of dust and bacteria.

Chemical Composition. When it became known that green, living plants decompose carbonic acid and liberate free oxygen, this was quickly assumed to be a prominent cause of the beneficial effects of forest air. It seemed plain that the air must be purer in the sense that it was richer in the life-giving free oxygen and poorer in the poisonous carbonic acid. It is an error, however, to make this the chief or

even an especially important hygienic factor. Actual analysis shows that this difference is too small and too uncertain to be a factor of any considerable importance. A sufficiently larger proportion of oxygen is not a special characteristic of forest air. (See Ebermayer—*Die Beschaffenheit der Waldluft*, Stuttgart, 1885.)

Ozone. Of more interest is the relative amount of ozone. While the direct effect of this was greatly overrated a few years ago, it is sufficiently well established that ozone has often a curative value, and it is also abundantly proven that forest air, and more particularly the air on the edges of forests, has a larger average ozone-content than the air over cultivated fields and towns. Indeed the air of cities is always relatively poor in ozone and within crowded dwellings it is usually entirely lacking.

There is a large amount of recorded observation on the relative amounts of ozone and its atmospheric distribution. The average is richer in forests than in regions distant from them, and richer on the edges and above the crown than within the forest itself, particularly of a deciduous forest. It is, as a rule, more abundant in *coniferous* forests, pine, spruce, fir, balsam, cedar and the like. This is doubtless due to the balsamic and terebinthine exhalations of many cone-bearing species.

The specific therapeutic effects of ozone need not be here discussed, farther than to call attention to the experiments of Professor Binz of Bonn on ozonized air promoting sleep, and of Dr. Blankenburgh in the Hartz, who experimented with it for many years and its especially beneficial results upon chronic nervous diseases. It is eminently probable that ozone is a factor in the restful and sleep-promoting influence of forest air, so often observed by physicians in their practice, and by laymen who visit the woods for rest and recuperation.

Then, too, ozone by its oxydizing power is a great destroyer of the gases produced by putrefactive decay and which are always unwholesome. This is perhaps the chief reason why there is less ozone in cities, and over-cultivated fields. It is there used up in the act of its destroying such gases. It is also probable that this is why ozone is more abundant over the crown of foliage of a forest, and in its immediate neighborhood, than it is within the forest itself, where it is partly used up in destroying the gases rising from the organic matter decaying on the forest floor. While the direct therapeutic action of ozone was doubtless formerly overrated, it is eminently probable that by its indirect influence on curative processes it is very important as a factor increasing the salubrity of forest air.

Marsh gas (Methane) is produced by the fermentation of cellulose under water. It has long been known that it was generated in forest

swamps and is believed to be pernicious to health. Its removal from the atmosphere has heretofore been attributed to the oxygizing action of ozone. Urbain has recently shown that ozone attacks it but slightly, and that it is destroyed by the action of living plants, and if this be true (as seems now proven), it would explain, in part at least, why forest swamps should become more insalubrious, for a time at least, after the trees have been destroyed than it was before. This is a common belief in the regions west of the Appalachian's and north of the Ohio. It is interesting to find, as Urbain's investigations seem to show, that the accumulation of unwholesome hydrocarbons as well as poisonous carbon dioxide (carbonic acid) are prevented by the action of the living forest foliage.

Dust. The dust in the air constitutes a much more important ingredient. That forest air is cleaner than that of the city or country is evident to the senses. Modern scientific investigations strongly confirm this and show that there is an enormous difference in the dust-content of forest air from that over an open and occupied country, both in respect to quantity and quality. Dust is always and everywhere a constituent of the air and the role it plays in the various atmospheric phenomena has been the subject of a large amount of investigation during the last thirty years, and especially since 1880, when Professor Aitkin of Edinburgh announced its relation to the condensation of watery vapor. Methods have been devised for counting the number of dust-particles in a given volume of air and numerous countings have been published. As might be expected, they are enormously more abundant in the air of cities and over-cultivated fields. The dust from the streets and roads, and from the fields and gardens, the dust produced by many operations in the industries, the smoke particles from the numerous chimneys, and the thousand and one other sources of dust, make the local differences very striking and they have been extensively studied. The amount and the unwholesomeness of this dust is intimately related to the density of the human population. The most harmful ingredients are decaying organic matter and the micro-organisms small enough to be raised by the wind, and especially the pathogenic bacteria.

When we consider that the air drawn into the lungs amounts to twenty or thirty pounds daily, containing an aggregate of very many millions of dust particles, and that much of this adheres to the moist surfaces within the lungs, we need not wonder that an excess of dust of any kind becomes harmful, and as the air of the forest is cleaner than the air of populous regions it must be more salubrious in this respect. I have for many years made a study of dust in its relations to various other atmospheric phenomena, and believe that its relative scarcity in

forest air is the most important hygienic difference between that and city air.

Bacteria constitute the most harmful ingredient in atmospheric dust. There have been very many investigations on the bacterial contents of the atmosphere, both as to kind and abundance. We have already stated that forest soil and water are both very much poorer in bacteria than that from cultivated fields, and the forest surface is such that those which are produced are not easily liberated into the air. Moreover, the winds are never so high, therefore the bacteria that are wafted there from outside sources fall sooner than they would if over the open country. The filtering action of the foliage is a factor in diminishing the suspended dust, as is easily seen on the dust-laden leaves in thickets by the roadside.

As an illustration of how rapidly bacteria diminish among trees, we may use Miquel's investigation. He carried on a series of comparative observations on the bacteria in the air in the central part of Paris and in the Park of Montsouri for five years, 1881 to 1885. The average number for that period was 3910 per cubic meter of air in the heart of the city and 455 in the park in the suburbs. Montsouri is a small park of about forty acres lying only two and a half miles south of the old and crowded part of the city. It is actually within the encircling fortifications of the city, yet the bacteria averaged only about one-tenth as numerous as in the air in the city streets. This, remember, was the average. The extremes were vastly greater, particularly in summer.

It is not safe, however, to push these comparative conditions as to trees too far. We may have treeless regions, if uncultivated, with even fewer bacteria in the air than is usual in forests.

Dryness, sunshine and freely circulating air are the great destroyers of bacterial life. Hence, an open, treeless country may be a very healthful place, if the conditions of climate and soil are also favorable. The air there is sometimes almost free from bacteria. There are regions in California, and indeed many places west of the one hundredth meridian, where the air is almost sterile. But in a populous region with abundant rains and cultivated gardens and fields, the forest air is always purer than other country air as respects bacteria.

Forest climate differs from that of the open country in several particulars, and this has been the subject of much study in several countries of Europe. Many series of observations have been carried on at forest experiment stations and other meteorological observatories. As an illustration, see Ebermeyer's "*Die Physikalischen Einwirkungen des Waldes auf Luft und Boden und seine Klimatologische und Hygienische*

Bedeutung," Berlin, 1873; founded on observations made mostly in Bavaria, specially directed to this end.

Forest climate somewhat resembles a sea climate in that it is a little purer as to gaseous impurities and is very much cleaner of dust, and is also of more uniform temperature. It differs widely from sea air in its milder winds and in those ingredients and odors which come from the trees themselves. Its gentler winds are probably its most important climatic character, as related to health, and the next in importance is its more uniform temperature.

Harsh and raw winds are tempered by trees, and so important is this and so well known that, in our own country, when a new open prairie is settled, trees are immediately planted to make a "wind break," for its protection to the health of the family as well as for the health and shelter of garden and orchard. The temperature in a forest is a little lower and is very much more uniform than that outside, not so hot in the hottest weather, nor so cold in the coldest weather, the daily, monthly and yearly range is decidedly less. The days are cooler and the nights warmer. The bleak winds of winter are less chilling and the hot winds of summer neither so dry nor so scorching. There is also less range in humidity, the air never becoming so very dry in woodlands as in the open fields in times of drouth nor in the midday heat. The differences in the temperatures of the soil are even more marked, and have been carefully studied by long series of observations made at the surface, and depths of one, two, three and four feet. The ground does not freeze so deeply, the daily, monthly and yearly range of temperatures are less and changes are neither so sudden nor so great.

The hygienic aspects of these several characters are especially obvious in their effects on the young, and feeble, the invalid and the aged. The combination of special characteristics of the soil, water, air and climate furnish a philosophical reason for the location of sanatoria and hospitals in forests or on their edges.

The psychological influences of forests are especially beneficial to very many persons. This is probably a relatively new hygienic factor, due to the absorbing sentimental love of nature which, to the present generation, endows forests with such a charm. This is a very modern sentiment. The ancients had none of it, nor did it exist in mediæval times. "This mysterious analogy between the human emotions and the phenomena of the world without us," as Humboldt expresses the sentiment which colors the poetry and literature of today and is so healthful in its influences, is entirely modern. To the ancients and mediævals as well, both mountains and forests were places to be shunned. They were held in fear as well as awe. The mountains

were the abodes of dragons and the dark forests were the homes of evil spirits.

As Europe emerged from mediævalism, the poets first, began to see beauties in mountains and forests and write or faintly sing about them. Later, scarcely more than a century ago, as the natural sciences began to expand, particularly geology and botany, the mountains and the forests became places of peculiar interest to students of nature, and were visited for scientific study. What we study we come to love. Science drove the dragons and demons away and led the learned and unlearned alike to admire and love the grand and sublime in nature. Now the mountains and forests have become the playgrounds of the people of our civilization, and what a gain this is to the world! To contemplate forests, and particularly mountain forests as moderns do, with mingled love and ecstacy as well as awe, has a soothing and healing influence of itself, and is often the best of medicines.

Neither in classical literature nor in the Bible, nor in the Koran, nor in the literature of the middle ages is there any evidence that the people loved forests or took pleasure in them or visited them for æsthetic gratification. I have looked carefully but in vain for evidence of any such popular sentiment. The authors wrote as if they purposely avoided saying more than was necessary about a disagreeable subject. Even in the works of Herodotus, that most eminent of ancient travelers and geographers, one finds absolutely nothing about forests. He tells about the rivers, and the mountains, and the deserts, and the fruit trees and the animals of the various countries of the known world, but he never so much as alluded to forests, other than in a very few of his descriptions, as of Ethiopia for example, he states merely that there is an abundance of trees.

I enlarge on this fact because I believe that this new sentiment, born of science and now stimulating our intellectual life and shaping our æsthetic pleasures, has a profound hygienic importance which will continue to grow with the development of our culture, that it is susceptible of varied application and that it is well for this Association to encourage this healthy sentiment and study its hygienic uses. I consider it important to the countries covered by this report. The forests of North America are preëminent among the forests of the world. They are preëminent for their richness in variety of species of trees, for the beauty and majesty of the trees themselves, for the sublimity and extent of the forests, and for their impressiveness on imaginations and emotions of men.

Forests may, however, be too rank for any but the healthy and the rugged. Tropical forests, if in rainy countries, are not resorted to for strengthening the feeble or healing the sick. No early civilization or

even advanced barbarism has ever sprung up in a forest-clad country. Assyria, Egypt, the whole Mediterranean region, Mexico, Peru, wherever an early civilization began, however unlike in climate, topography, productions, and facilities for commerce, the regions were all alike in this, that there was much open or treeless country, with trees sufficiently accessible for the uses of civilization, but land open for cultivation. When Roman law and culture was carried from the drier Mediterranean region over the Alps and into the wetter and forested regions north, as the civilizing of a new people went on, new sanitary problems were presented to the Caucasian race. There is no more interesting chapter in the history of the fifteen hundred years, from the third to the eighteenth centuries, than that of the new sanitary problems thus introduced. Here in America the case was different. It was a migration of civilized people who carried their civilization with them. It was colonization, not conquest. Agriculture feeds civilization. Therefore, when a civilized people attempt to colonize and occupy a forest-clad country the first work is to conquer the forest and subdue the soil to tillage. The battle with the forests is then always a hard one. The early European colonists to this country, everywhere north of the gulf, were confronted by this foe to progress. The battle was a long as well as a hard one. It was nearly two hundred years before the reluctant forests retreated more than a few miles from the navigable waters. It was a war of extermination. Even where the wood and timber were cut for use, it was usually a work of devastation, with little care, often none whatever for the preservation of the forests for future use.

It was not until the destruction had gone too far that there has been a popular awakening to the dangers involved. After nearly three centuries of education in the destruction of forests, it takes time to educate the people and create a strong sentiment for the salvation of the forests that are left. Much land, unsuitable for agriculture but eminently useful for forests, has been made desolate which should be reforested. To help create such a sentiment should become one of the functions of this Association.

The wider the scope of any subject, the more indefinite its limits and boundaries. Forestry passes insensibly into the management of parks, landscape gardening, horticulture, the artificial production of trees for medicinal and commercial products, shade trees for country and city, and so on.

Parks and Forest Reservations. The original idea of both forests and parks were reservations for pleasure grounds, as distinct from lands for mere economic use. Forests were open, parks were enclosed. According to the first legal definition (Manwood, *"A Treatise and*

Discourse of the Laws of the Forest," London, 1598), "A Forrest is a certen Territorie of Woody grounds & Fruitful pastures, privileged for wild beasts and foules of Forrest, Chase, and Warren to rest and abide in, in the safe protection of the King, for his princely delight and pleasure, * * * to the end that the same may the better be preserved and kept for a place of recreation and pastime, meete for the royall dignitie of a Prince." Bladdiston, two hundred years later (in his large and authoritative work ("*The British Sportsman; or Nobleman, Gentleman and Farmer's Dictionary of Recreation and Amusement,*" London, 1792), entirely confirms this. He quotes Manwood as to what a forest is and adds that "Parks and Warrens are places where deers, hares, rabbits and other game are enclosed for the purpose of increasing them and having a ready supply at all times, either for the table or for the chase." These English laws did not differ essentially from those of the other countries of Western Europe, in that it was the use of woodlands for pleasure and recreation, reserved for royalty and the privileged classes. In Europe it remains so to this day, although now some of the privileges have become more public.

I need not discuss here the wisdom of our national government, and of several states and municipalities in establishing parks as pleasure grounds for public use. It is in accordance with our extension of privileges to all citizens alike. No further argument is needed as to the relation of such reservations to the public health. In fact, that is usually now urged as one great and often the chief reason for their establishment. Even in city parks, a leading aim of the landscape gardener who plans them, is to imitate in them so nearly as is possible certain conditions and aspects which are natural to forests, to impart to them those forest characters which makes the contemplation and use of them so restful, healthful and soothing, a relief to nerves which have become tired with city noises and the distractions and irritations incident to city life. In our country, we can draw no sharp sanitary line between forests and parks. It is a continuous grade from the small city park to Yellowstone Park, and from the great Yellowstone to the greatest Olympic forest reservation.

Shade Trees. The subject of shade trees only needs mention here further than to say that their influence is in many ways healthful, psychologically and physically; also that they may be too abundant near the immediate dwelling, in that they increase dampness, especially in certain climates, and may too much obstruct the sunlight. I have known several families to suffer from consumption, where I have no doubt whatever that the disease was invited and intensified by the dense shade of the beautiful and beloved trees about the old homes. In this matter the choice of the species of trees to use has been too lit-

tle considered from the hygienic point of view. The open habit of the American elm is better for many places than the dense and darkening habit of the sugar maple. I have, for a number of years, carried on a series of observations on this matter in New Haven, Conn. The "City of Elms" has also many sugar maples in its streets and its climate is very humid, especially so in the dog days. The streets dry quicker under the elms than under the maples, even when growing near each other on the same streets, and the houses are less darkened when placed near elms than maples. The difference in the density of the shade is very marked. Other species might be cited to illustrate the same fact and point the advice to select the species for its special place. Nature does that and she succeeds.

The medicinal products of forests, and their relations to forestry. Quinine is a notable illustration. When the natural cinchona supply became scarce in South America, the European governments having tropical colonies, especially the English in India and the Dutch in Java, began its cultivation, founding its artificial production on careful scientific investigations. You know the result. Cultivated plantations now supply most of the quinine of commerce. Now that this country has extended its possessions into the tropics, this may yet become a live question with us. There are other forest medicinal products of our American trees and shrubs, some of wide popular use, of which witch hazel is a familiar example. Whether the cultivation of trees for this use will ever be of much importance in this country and Canada cannot now be stated; it is, however, worth mentioning, and in Mexico will undoubtedly become an important matter.

In conclusion, we may say that the "Relations of Forestry to the Public Health" on this continent are so many and so great that boards of health should give their official attention to the matter whenever practicable, and in such ways as the local conditions suggest. Several of the state boards have already taken an active part in the promotion of forestry, and in the protection and salvation of existing forests, but most of them have done nothing officially in this line, although many of the individual members of state and provincial boards have unofficially done much as individuals and as public spirited citizens. The local conditions are so unlike that no short rules of practice can yet be formulated for adoption everywhere. The problems in Connecticut and California, in Mexico and Canada, in Nebraska and Oregon are so very unlike, that action in each state or province must be planned to suit the local conditions. But we believe that the American Public Health Association can be a powerful factor in advancing the good work, by taking an active interest in the general subject, educating the public as to its hygienic importance, aiding in the establishment

of forest reservations under public management, municipal, state and national, and urging that the practical management of our public parks and forests be by experts, educated in the science and trained in the art of forestry. We would recommend the public ownership of such lands as are worth more for public forests than for agriculture, to be administered as a branch of the public service, in the interest of the public health as well as for the economic welfare of the people.

CIRCULAR OF THE AMERICAN PUBLIC HEALTH ASSOCIATION ISSUED BY THE COMMITTEE ON CAR SANITATION.

By Prof. S. H. WOODBRIDGE, Chairman, Boston.

The origin of a large proportion of the sickness from which mankind suffers is traceable to infection through direct or indirect contact of those afflicted with communicable disease with the well. The vital importance of reducing the liability of the transmission of such disease is therefore self-evident. Such transmission is most likely to occur where the well are in close and protracted contact with the infected, or with surroundings which the infected have contaminated. In no other class of enclosures are so many of the entire population aggregated as in vehicles for public carriage, and nowhere is the presence of infectious disease more liable and common. Beside the usual proportion of the ill among the well, in such vehicles there are those whose illness induces them to travel either homeward for treatment, or for convalescence, or demise, or to climates promising relief from disease, or a prolonging of life. For these reasons, such enclosures, more than any other places of public assembly, demand the effective attention of sanitary and legislative authorities, with the view of reducing the liability of transmitting disease; first, by the maintenance of the most practicable sanitary conditions, and second, by excluding from such places those known to be, or suspected of being, contagiously affected.

To this end the efforts of the American Public Health Association have been directed for several years, and as a means for giving greater effectiveness to its efforts, the Association issues this circular, for the purpose of calling the attention of railroad managements, and of State and other boards of health, throughout the States, the Provinces and Mexico to the essentials to be provided and to be avoided in order to make public conveyances, in matters of hygiene, all that the public has a right to demand.

The American Public Health Association regards as imperative the following precautions for the protection of the health of the traveling public.

First. The finishing of the interior of railway coaches with hard, plain, smooth and polished surfaces, and the disuse of such carvings, mouldings, groovings, or other finish as furnish lodgment for dust and dirt.

Second. The furnishing of the interior of railway coaches with material as non-absorbent and as cleansible as practicable. This applies to floor covering, seat and seat-back upholstery, window screens, berth curtains, and bedding.

Third. The ventilating of railway coaches by such means as shall continuously furnish not less than 1000 cubic feet of air an hour for each occupant of day, parlor and sleeping coaches, when filled with passengers, and as shall enter, distribute and remove such air in an effective manner for doing ventilating work without troublesome draughts.

Fourth. The regulating of the artificially maintained temperature of the coaches, by automatic or manual means, within such limits as shall prevent the debilitating effects of overheating, and the harmful effects of chill.

Fifth. The periodic, frequent and thorough cleaning of coaches and their furnishings without particular reference to the visibleness of dirt; the washing of floors; the removal of seat upholstery outside the car for cleaning; the removal of dust from fabrics by air blast or effective beating, and from surfaces by moistened cloths. Also the avoiding of such methods of interior cleaning while coaches are in transit as shall raise the dust and float it in the air of the occupied coach; and, when cleaning in yards is attended with dust raising, the wide opening of all doors and windows during the process.

Sixth. The periodical disinfecting of the interior of the coaches, by the use of disinfectants in water employed for floor washing, and in moistened cloths used in dusting, such treatment to include cleansing of the sanitary fixtures and cuspidors.

Seventh. The excluding from railway coaches, or other public conveyances, of persons known to be, or suspected of being, ill with communicable diseases; or the isolating of such persons in apartments appropriately arranged for their complete atmospheric separation from the rest of the vehicle, and for effective ventilation, and for thorough cleansing and disinfection after use by such persons.

Eighth. The sterilizing of the interior of coaches by subjecting them and their contents to the action of sterilizing gases, vapors or fumes, and by methods of recognized efficacy. Such treatment should be followed whenever any known or suspected cases of communicable disease shall be found among the passengers; and periodically, though no such case shall be observed. This treatment applies to all furnishings, such as bedding, mattresses, pillows, blankets and curtains. Sheets and pillow-cases should receive sterilizing treatment in the laundry process.

Ninth. The furnishing of water and ice from sources proved by frequent and reliable tests to be free from harmful contents; and in the absence of such water or ice, the artificial and effective treating of the best obtainable supply of water for its purification, and the use of ice artificially made from such water.

Tenth. The prohibiting, under an enforced penalty, of expectoration on the floors and other surfaces of coaches, and the providing of suitable and sufficient cuspidors for the use of passengers.

Eleventh. The frequent cleansing and periodical sterilizing of tanks for drinking water, and the handling of ice with tongs.

The Association regards as desirable for the further protection of the health of the traveling public:

First. A discouraging of the use of the common drinking cup, and an encouraging of the use of the individual cup, or the fountain jet.

Second. The using of light colored or white material for berth blankets and curtains, for the purpose of making dirtiness evident, and cleaning correspondingly frequent and thorough.

Third. The disposing of excreta by means which shall not expose the public or passengers to danger from the desiccation and pulverization of such material, and the resulting dissemination of morbific dust, due to the filthy and dangerous practice of scattering excreta over the railroad beds.

The precautions herein urged as imperative, and recommended as advisable, apply with equal force to station premises.

REPORT OF THE COMMITTEE ON CAUSE, PREVENTION AND DURATION OF INFECTIOUS DISEASES.

A GENERAL REVIEW

By the Chairman, A. WALTER SUITER, A. M., M. D., Herkimer, N. Y.

By the rapid and continuous evolution of sanitary science in recent years it has come to pass that an uneventful year in the study and observation of the cause and effects of human contagions and infections, and the means by which their prevention may be accomplished, is quite unknown. This remark applies with equal force to similar affections of certain of the lower animals and their relationship to those of man.

The passing year has been by no means exceptional in this respect, and such a wealth of material presents itself to your committee as to make it seem a difficult task to prepare a report regarding pertinent scientific events, which may be considered comprehensively interesting and useful as record, and keep it within the limits prescribed by the rules of the Association.

It will be the purpose of the committee, however, to invite attention as briefly as possible to some of the most important topics within the scope of its mission.

Existing circumstances make it seem wise that the somewhat extended references in recent reports of this committee relating to the current epidemic of variola should be supplemented at this time.

Unfortunately it cannot be said that there has been an abatement of this disease during the past year. *Per contra*, the deplorable fact must be noted that it is at this present date even more widespread than at any time since the epidemic began in 1897. The following statistical summary, compiled under the efficient administration of the United States Marine Hospital Service, may be placed in evidence:

Total number of cases reported from December 28, 1900, to June 28, 1901	30,710
Total number of deaths	552
Total number of cases for the same period in 1900	12,566
Total number of deaths	682

These figures represent a mortality of 1.80 per cent. in 1901, while in the previous year it was 5.42 per cent.

The statement, therefore, made in the last report of this committee to the effect that the disease diminishes in severity as it increases in area of distribution and numbers affected, continues to be applicable.

The highest rate of mortality reached during the year is shown to have been in the City of New York, in which during the period above mentioned 1376 cases were reported with 235 deaths.

This is a death rate of 17 per cent., which, comparatively, is enormously disproportionate to that of other localities, and is probably due in great degree to overcrowding and other insanitary tenement house conditions, together with, (and particularly) the almost universal neglect of proper precautionary vaccination in the early life of the present generation. The latter statement is accentuated by the following record of the Chicago Board of Health: "Out of the total 171 cases of smallpox found in Chicago between November 30, 1900, and April 10, 1901, 140 had never been vaccinated, only 2 out of the 171 cases exhibited typical scars of successful vaccination."

It still obtains that we are compelled to defend vaccination and that diagnosis is still a subject of disastrous controversy. Most deplorable of all is the fact that even members of our own profession may be found arrayed against the application of conclusively demonstrated protective measures, and contending for the non-acceptance of the only proper diagnosis consistent with the control of the epidemicity of the disease—a situation which, to sanitarians at least, seems inexplicable in the extreme.

A remarkable symposium and discussion on smallpox took place in the Section on Practice of Medicine at the meeting of the American Medical Association at St. Paul, Minn., in June of the current year. On that occasion the suggestion that the diagnosis of the prevailing disease is in doubt and that a new name is required to characterize the prevailing epidemic was most vigorously opposed. After the discussion the following resolution was adopted by the joint Sections on Practice of Medicine, and Hygiene and Sanitary Science:

"Resolved, By the joint Sections of Practice of Medicine and Hygiene and Sanitary Science, that the disease now prevailing extensively in the United States and called in some instances 'pseudo smallpox' is genuine smallpox, and should be so treated with vaccination and quarantine by all health authorities."

It seems to your committee most unfortunate that such authoritative statements as the following are possible at this progressive stage in sanitary administration: "Smallpox, at most recent dates, is less prevalent abroad than in the United States," and, from the City of New York, "Smallpox continues unabated; indeed, it is increasingly prevalent throughout the city with an average of from ten to fifteen new cases daily. During the four weeks ending June 29 there were 344 cases reported with 62 deaths. Since the first of January in Manhattan alone about nine hundred cases have been discovered.

This is more than the record for any previous year since the health department was established." Again, from the state at large: "Smallpox mortality in the state during June reached 74, the highest number for any month in the state's history as verified by the records of the health board."

As contradictory events these are interesting parallels to the fact that in 1896 there were 443 deaths from smallpox in the city of Gloucester, England, in Jenner's own county—all from neglect of the simple but certain precaution which, at the risk of obloquy and disgrace, Jenner strove so long and suffered so much to establish. Contrast with that the following statement, recently made, and the antithesis is complete: "During the same year and the next one there were in well-vaccinated and re-vaccinated Germany, only 15 deaths from smallpox throughout a population of 53,000,000"![1]

Let us continue to hope that we may soon see the end of unreasonable controversies relating to diagnosis, and the senseless outcries of the well-meaning but misguided anti-vaccinationists.

It may be well to here point out that the search for the specific causative agent in the production of variola and vaccinia, which presumably have a common microbic origin, has by no means been abandoned. It may be said to have begun with Sacco, who found peculiar granules in vaccine lymph in 1809.

Various micro-organisms have since that time been discovered and described by different investigators. At the present date the belief seems to obtain that the origin of these diseases depends upon a parasitic organism—a protozoon first described by L. Pfeiffer in 1887. Experimentation along this line is more or less constant and some results have recently been obtained that strikingly tend to the support of the parasitic theory—notably those reported by Funck and Copeman in the British Medical Journal, 23d February, 1901.

By and large, the most momentous—even wonderful—scientific event during the passing year in the etiologic study of human infections may be said to be the series of experiments confirmatory of the portentious discovery of the relationship that the mosquito (culex fasciatus Fabr.) bears in the transmission of yellow fever. And no report of this character can be considered in any degree to approach completeness that does not call attention, as a matter of record at least, to this epoch-making research. It is a matter of pride to state that the discovery was first given to the world through this Association at its meeting in Indianapolis last year, when a preliminary note was presented by Major Walter Reed, surgeon, U. S. A., and his colleagues on the American commission in Cuba, Acting Assistant

[1] President's address, British Medical Association, July 30, 1901.

Surgeons James Carroll, A. Agramonte and that martyr to science, Jesse W. Lazear. And here let us, as we drop the sympathetic tear, place high on the altar of fame the memory of the devoted self-sacrifice of this noble man, along with that of Walter Myers of the British Yellow Fever Commission in South America, who similarly gave up his life in search of knowledge in this same field of investigation. This is the place also to express admiration for the splendid personal courage of the brave young soldiers who jeopardized their lives, as one of them expressed it, "solely in the interest of humanity and the cause of science." These young men voluntarily submitted themselves to the bites of the infected insects in some instances and to the supposedly infected clothing in others, all for the purpose of aiding in carrying out the details of the experimental plan proposed by the commission. The limits of this report forbid a detailed description of the methods employed in this interesting work.

The results of the later experiments, however, are briefly yet comprehensively summarized in an article by Major Reed and his colleagues read before the Pan-American Medical Congress in Havana, Cuba, February 4-7, 1901, as follows:

1. The mosquito (C. fasciatus) serves as the intermediate host for the parasite of yellow fever.

2. Yellow fever is transmitted to the non-immune individual by means of the bite of the mosquito that has previously fed on the blood of those sick with the disease.

3. An interval of about twelve days or more after the contamination appears to be necessary before the mosquito is capable of conveying the infection.

4. The bite of the mosquito at an earlier period after contamination does not appear to confer any immunity against a subsequent attack.

5. Yellow fever can also be experimentally produced by the subcutaneous injection of blood taken from the general circulation during the first and second days of the disease.

6. An attack of yellow fever, produced by the bite of the mosquito confers immunity against the subsequent injection of the blood of an individual suffering from the non-experimental form of this disease.

7. The period of incubation in thirteen cases of experimental yellow fever has varied from forty-one hours to five days and seventeen hours.

8. Yellow fever is not conveyed by fomites, and hence disinfection of articles of clothing, bedding, or merchandise, supposedly contaminated by contact with those sick with this disease, is unnecessary.

9. A house may be said to be infected with yellow fever only

when there are present within its walls contaminated mosquitos capable of conveying the parasite of this disease.

10. The spread of yellow fever can be most effectually controlled by measures directed to the destruction of mosquitos and the protection of the sick against the bite of these insects.

11. While the mode of propagation of yellow fever has now been definitely determined, the specific cause of this disease remains to be discovered.

These statements quite completely set forth the *status praesens* of this attractive subject and are for that reason placed on record here.

The establishment of the rôle of the anopheles in the propagation of malaria, that of the musca domestica (and perhaps many varieties of flies) in typhoid fever, the culex fasciatus in yellow fever, and the probable agency of other diptera in the causation of various diseases has added a new department to our usual classification into air-borne, water-borne and soil-borne diseases. We must now speak of those that are *insect-borne*, and a new field for investigation is presented that is likely to lead to most important results in sanitary application. Revolutionary changes regarding methods of protection ordinarily practised are suggested.

Although the above conclusions present demonstrations that are quite beyond controversy, your committee would call attention to the fact that the evidence does not seem to fully bear out the declaration that disinfection of clothing, bedding, etc.. is unnecessary; for, as was pointed out in a recent editorial article, "it has not been shown that the intermediate host might not pick up, as it were, the parasite of the disease from the contaminated materials."[1] Other objections to this statement will readily present themselves to conservative sanitary minds. The logical outcome of these special studies of recent years is that sanitarians will be hereafter confronted with the great problem—how to destroy the pestiferous insect. Much activity along this line may already be noted in various cities and countries, so far at least as concerns the two parasite-bearing species of mosquito. Until better means are known this seemingly quixotic undertaking will doubtless be carried out upon the plans proposed by Mr. L. O. Howard, Chief Entomologist of the Department of Agriculture at Washington, viz:

"First, the treatment of their breeding places with an agent destructive to the life of the larvæ; second, the abolition of breeding places by drainage; and third, the introduction of natural enemies into those breeding places which it may be impracticable or undesirable to drain or to treat with larvicides."[2]

[1] Journal American Med. Ass'n, Feb. 16, 1901.

[2] Editorial Medical Record, July 20, 1901.

The first proposition is now probably best met by the use of petroleum, liberated by specially prepared apparatus within the water of the small stagnant pools where the eggs are deposited.

In experiments very recently made on Staten Island (August, 1901,) under the direction of Dr. A. H. Doty, Health Officer of the Port of New York, "the apparatus used consisted of wooden floats of different sizes having underneath a network of small perforated iron pipes with the openings on the under surface. These are connected by a rubber hose with a portable oil tank containing oil under air pressure. In this manner the oil was forced almost to the bottom of the pool."

The destruction of the infected insects in houses will best be accomplished, after the effectual closing of the same, by fumigating with sulphur dioxide, chloride, formaldehyde or pyrethrum powder.

To carry out the third proposition minnows and fish, such as the golden carp, sticklebacks, top-minnows and sunfish, also the larvæ of the dragon fly, may be employed.

The bubonic plague situation is becoming more and more menacing as time goes on, and, although no public manifestation of apprehension is apparent in more highly civilized quarters, the truth requires the statement that present indications point to its pandemicity sooner or later throughout the world. Certain evidence of its extension and increasing virulence is constantly at hand. The disease is at present (August, 1901,) reported as extending in South Africa, where it only recently developed, and is reported prevalent in the following countries: Brazil, China, Egypt, French possessions, Hawaiian Islands, India, Japan, Mauritius, Paraguay, Philippine Islands, Turkey, and San Francisco in the United States.

Professor Robert Koch, at the recently held Tuberculosis Congress in London, referred to the bubonic plague as being "the pestilence which is at this moment in the foreground of interest." The very recent recrudescence of the pest in San Francisco (4 deaths in July, 1901) coupled with the statement lately made (Journal Am. Med. Association, April 13, 1901) that "it seems extremely probable that though the first case was discovered in March of last year, plague has existed in San Francisco among the Chinese for at least two or three years—possibly longer," may well cause us to think of the possibility, arguing from the experience of other localities, of a sudden transformation of this epidemic to proportions that would immediately threaten the welfare of the people of the whole United States, and contiguous countries as well. It is still the consensus of opinion that rats are the principal propagators of this disease, but how it is communicated from the rat to man is not as yet established.

The theories most patronized are contagion and infection, direct, or through the medium of the air or soil, communication by means of suctorial parasites carrying the germ from the body of the infected rat to that of man, and the conveyance by flies of infected matter which they have consumed. The insect-borne theory seems at present to overshadow all others in importance and it is believed that an intermediate host may yet be found in flies or fleas.

As regards measures for limiting the spread of epidemics and individual protection it may be said that, in addition to the universally recognized hygienic efforts to transform filth conditions into those of cleanliness and the use of the Haffkine prophylatic, referred to in the last report of this committee, the study of methods for the destruction of the pest-conveying rats is receiving great attention.

No completely satisfactory method for this purpose has thus far been proposed. The devising of means for the wholesale slaughter of the elusive rodent presents a problem of no ordinary character. The use of chemical poisons for this purpose being attended by so much danger to domestic animals as well as man, efforts have been made to find an otherwise harmless microbe which would be pathogenic to rats, and by means of which fatal epizoötics might be created and propagated among them. Several observers have isolated bacilli pathogenic to different varieties of rodents—all, however, having morphological characteristics similar to the bacillus typhi murium isolated by Loeffler from a disease of white mice. J. Danyz, of the Pasteur Institute, Paris, lately isolated such a bacillus from harvest mice and by an ingenious and laborious process of successive cultures obtained one that was very virulent which was used as a "rat virus," and for which great usefulness was claimed. Dr. M. J. Rosenau, Director of the Hygienic Laboratory of the U. S. Marine Hospital Service, obtained from the Pasteur Institute a culture of this bacillus and proceeded to make a practical study of its value. In a report very recently issued he states that it is really fatal to rats when ingested, but that "the effect depends somewhat on the amount ingested." He also states in detail the experimental work undertaken and from it concludes that "in many respects it resembles a chemical poison, with this great advantage, viz: that it is harmless, in so far as known to man and domestic animals. It has the great disadvantage, that chemical poisons do not possess, of rendering the animals immune by the ingestion of amounts that are insufficient to kill, or by the ingestion of cultures that have lost a little of their virulence."

The above statement is here introduced principally for the purpose of indicating the trend of thought in this very important field of study.

Reference should also be made herein to the continuation of the remarkable studies relating to the viability of the plague germ (bacillus pestis), which have also been undertaken under the efficient direction of Dr. Rosenau, above quoted. The organism, obtained from seven sources, viz: Djiddah, Oporto, Rio de Janeiro, Bombay, the New York Quarantine case, Glasgow and San Francisco, has been subjected to a great number and variety of tests to demonstrate the conditions by which its vitality may be influenced, such as the effect of temperature, moisture, sunlight, the soil, hot and cold water, the effect of microbial (saprophytic) symbiosis, gaseous and chemical disinfectants, etc., etc. This timely and very valuable scientific laboratory work has been in progress, by Dr. Rosenau and his associates, for a long period of time and is of such pertinent and far-reaching relative importance that the summary of results, (Bulletin No. 4 of the Hygienic Laboratory, U. S. M. H. S.), may quite justifiably be reiterated in this review.

1. The bacillus pestis is not a frail organism. It resembles the hemorrhage septicæmic group or the cocco-bacilli as far as its viability is concerned.

2. Temperature is the most important factor in the viability of the plague bacillus. It keeps alive in the cold, under 19 degrees C., a very long time. It dies quickly, especially when dried at the body temperature, 37 degrees C.

3. Moisture favors the life of the bacillus pestis. It usually dies in a few days when dry, even in the presence of albuminous matter, provided the temperature is above 30 degrees C. It may keep alive and virulent when dry for months in the cold, under 19 degrees C.

4. Sunlight kills the organism within a few hours, provided the sun shines directly upon the organism and the temperature of the sun is over 30 degrees C. The effect of sunlight is not very penetrating.

5. The virulence of the bacillus pestis is often lost before its vegetability.

6. It is unlikely that new merchandise would carry the infection. The organism usually died in a few days on the surface of objects such as wood, sawdust, bone, paper, etc.

7. Clothing and bedding can harbor the infection for a long time and may act as fomites. The bacillus lives for months when dry in albuminous media at temperatures under 20 degrees C.

8. Food products may carry the infection of plague. The bacillus lives a long time in milk, cheese and butter. It usually dies quickly on the surface of fruits and prepared foods.

9. The organism may live a long time in water, although plague is not a water-borne disease.

10. The plague bacillus does not live long on paper, and first-class mail is therefore not apt to convey the infection.

11. The colder the climate the greater the danger of conveying the infection of fomites—clothing, bedding, food, merchandise, etc.—and more extensive disinfection is required in such a climate in combating the disease than in tropical regions.

12. The plague bacillus is destroyed by sulphur fumigation and by formaldehyde gas in strengths in which these disinfectants are usually employed. The gases can only be depended upon as surface disinfectants. In disinfecting ships, warehouses, dwellings, and other places infested with rats, fleas and vermin, sulphur is better than formaldehyde, because formaldehyde gas fails to kill the higher forms of animal life.

13. A temperature of 70 degrees C. continued a short time is invariably fatal for the plague bacillus. The ordinary antiseptics are all efficacious in their usual strength for nonspore-bearing organisms. Efficient surface disinfection may be accomplished by exposing objects all day to the direct sunshine on warm days. The temperature of the sun must be above 30 degrees C.

Since the summer of 1899 studies have been carried on in the Institute for Infectious Diseases in Berlin with special reference to the bacteriological diagnosis of the plague. Among the many things studied and reported upon by Kolle and his associates the reference to the polymorphism of the bacillus pestis is perhaps most important. Assurance is given, however, that the characteristic bi-polar staining can always be accomplished by careful technique.

It will thus be noted from all that has been said that, with the vast amount of certain knowledge that we now possess concerning the nature and manifestation of this dreadful infection, we are at least scientifically well-prepared should a general outbreak be imminent. It is quite safe to say that no epidemic disease was ever more thoroughly anticipated.

In addition to what will be so well said by Dr. Battle in his contribution to the work of the committee on the present condition of our knowledge *in re* the tubercle infection, a few words relating to the diminution of tuberculosis, and the matter of state and municipal control, may not be inappropriate in this review.

Congratulations are certainly in order upon the aroused interest of the public, and the increasing activity of legislators and public officials as to the providing of means for protection from the dangers of this "great white plague." Evidence of this is seen in the estab-

lishment of sanatoria for the special treatment of the tuberculized by various nations, states and municipalities at governmental expense, by private charity, and in some instances (as in Germany) by life insurance companies.

This beneficent movement is progressing to a greater or less extent in England, France, Germany, Russia, Italy, Norway, Denmark, Sweden, Switzerland, Austria, Hungary, Poland, Spain, Portugal, Holland, and (of particular interest to this Association) in Canada, by the United States government, the state and city of New York.

The proofs of the exceedingly great benefits of the sanatorium treatment constantly accumulate, and it seems not too much to say that it may ultimately become the most important factor in the limitation and control of the tubercle infection.

One of the sections of the recent Congress on Tuberculosis in London, previously referred to, was devoted in part to the consideration of sanatoria as special institutions. The topic was thoroughly viewed, and a most hopeful state of affairs was shown by declarations from various sources of the high percentage of arrested development of the infective process, and of complete recoveries. By resolution, the Congress at its close made the following pronouncement:

"The provision of sanatoria is an indispensable part of measures for the diminution of tuberculosis."

Pre-eminently the most important outcome of this Congress is the universal discussion of the question raised by Professor Koch in the address, viz: The transmissibility of bovine tuberculosis to the human subject. Professor Koch declared his belief in the negative of this proposition, and to the effect that the susceptibility of man to the meat and milk (or butter made from it) of tuberculous animals is so slight, if it really exists, as to make it inadvisable to take measures against its transmission; that the principal if not the only source of infection is by means of the sputum of tuberculous patients, and that efforts should be chiefly addressed to the disinfection of such sputum and the prevention of its diffusion. Professor Koch spoke in detail of his efforts during the past two years to bring about experimental tuberculosis in cattle and swine by feeding them with human tuberculous sputum, by hypodermic, intra-peritoneal and intra-venous injection of the same, and by inhalation of the sprayed bacilli. Inoculation of bovine tubercle bacilli into cattle, on the other hand, invariably and promptly produced severe and extensive tuberculosis.

Experiments of a similar character were performed by Dr. Theobald Smith, a distinguished member of this Association, the results of which were published in 1898. He also demonstrated at that time

both morphological and cultural differences between the bovine and human tubercle bacilli.

The reverse order of experiment to prove the immunity of man to the bovine tuberculosis being impracticable, the *status quo* of this very weighty problem must still obtain. It should be said, however, that although the question he has raised is by no means a new one, Professor Koch has nevertheless rendered an incalculable service to mankind, if his timely declaration shall have the effect to stimulate renewed study and research, to the end that this much-mooted question may be definitely and satisfactorily determined.

Your committee earnestly hopes that this cursory review, together with the notes and memoranda that will be submitted from individual members, may be believed to be a somewhat faithful representation of the principal events and circumstances concerning those infections that are at the present time particularly interesting to the public and to sanitarians.

PRESENT STATUS OF DIPHTHERIA.

By WILLIAM C. WOODWARD, M. D., LLM.,

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A definition of diphtheria satisfactory from the standpoint of the sanitarian has not yet been formulated. Persons in good health who have not recently suffered from diphtheria cannot be said to have diphtheria because of the presence of virulent diphtheria bacilli in their air passages, and under such circumstances there appears to be no sufficient ground for regarding diphtheria patients as still suffering from that disease after the complete disappearance of the clinical symptoms, even though diphtheria bacilli continue to be present. The only practicable way of avoiding this difficulty, so far as the matter of quarantine is concerned, appears to be to define, in the statutes governing such matters, the exact meaning of the term "diphtheria," or to base the quarantine regulations merely on the infective qualities of the individual rather than upon the presence of disease.

Recent studies have tended to establish the existence of a bacillus identical with the diphtheria bacillus in form, but without its pathogenic properties, and has shown certain nice distinctions between bacilli formerly regarded as morphologically identical with the diphtheria organism. It has, however, failed to demonstrate any method other than animal inoculation by which to determine the virulent or non-virulent properties of bacilli classed morphologically as diphtheria bacilli.

Virulent diphtheria bacilli may be found in the air passages of any individual whatsoever without regard to clinical symptoms. There is, however, relatively greater danger from persons presenting the clinical symptoms of diphtheria because of the increase in such cases in the secretions of the air passages, and of the presence of the diphtheritic membrane, both of which tend to excite symptoms and to afford media likely to carry the bacilli into the surrounding atmosphere. The danger is, to a certain extent, in proportion to the severity of the clinical symptoms, certainly because of the presence of the features just mentioned and probably because of the relatively greater virulence of the bacilli in most of the severe cases. The extent of the danger from persons carrying virulent diphtheria bacilli in their air passages but showing no clinical symptoms can on no empirical or

scientific basis be regarded as affected by the fact that such person has or has not recently convalesced from diphtheria unless it can be shown that the bacilli have not yet persisted in the throat of the well person beyond the ordinary period of incubation of diphtheria. Under conditions just mentioned the initial clinical symptoms may develop before the patient is aware of their significance and the supposedly well person infect others. Aside from this feature the chief danger from healthy persons, whether recently convalesced or otherwise, having diphtheria bacilli in their air passages, is probably through the use in common of drinking cups, tableware, etc.

Diphtheria infection apparently depends on the relation between the virulence of the infecting organisms and the susceptibility of the individual attacked. It involves, therefore, questions of quantity as well as quality of the infection, and of degree as well as character of personal immunity and vital resistance. Unsanitary conditions tend to diminish the vital resistance of the animal organism and, therefore, make it more prone to succumb to attack. Personal uncleanliness on the part of the patient and of those in attendance on him favors the spread of the disease by increasing the dissemination of infective particles through the atmosphere. Overcrowding tends to the same end by diminishing the absolute quantity of air in the infected room without a corresponding diminution in the amount of infection, thus increasing the density of the infection in the atmosphere, and increasing the likelihood of those exposed to such atmosphere receiving effectively toxic doses of infection. Unsanitary conditions, including personal uncleanliness and overcrowding, are, therefore, active agents in the spread of diphtheria infection.

The prevention of diphtheria requires theoretically the isolation of all persons having in their air passages or elsewhere bacilli morphologically identical with diphtheria bacilli until and unless the nonvirulence of such organisms has been demonstrated. Practically isolation to this extent is impossible. In fact it may be questioned whether it is practicable to quarantine even persons showing no clinical symptoms of diphtheria, but having infective diphtheria bacilli about them; until something definite is known as to the number of such individuals in a community under ordinary circumstances this cannot be determined; and, if such persons are not to be quarantined, there appears to be no sufficient ground for the quarantining of diphtheria patients after the disappearance of clinical symptoms, although they may upon examination show the presence of diphtheria bacilli.

The education of the public with reference to the danger of the promiscuous use of drinking cups, etc.; the promulgation and enforce-

ment of regulations requiring tableware to be disinfected each time after use, in all public eating houses and similar places; and the particular education of those in attendance on diphtheria patients as to the possibility of spreading the disease through tableware used by them (the attendants), and subsequently used by others in the household without disinfection, are factors which may be relied upon to prevent to a certain extent the spread of diphtheria from patients convalescent from that disease but still carrying the organisms, and from persons infected with the organisms but who have never suffered with the disease.

The proper use of antitoxin for the relief of clinical symptoms of diphtheria, and its use among persons who have been exposed to infection, for the purpose of preventing the development of such symptoms, may be regarded as an important factor in the prevention of the spread of the disease. The enforcement of all regulations tending to promote the health of the citizen and to prevent overcrowding, and the education of the masses in the matter of personal cleanliness and with respect to the causes and methods of preventing contagious diseases, are of prime importance.

TYPHOID FEVER.

By Dr. FRANK W. WRIGHT, New Haven, Conn.,

Member of Committee on Cause, Prevention and Duration of Infectious Diseases.

The old theory that the infection of typhoid fever is conveyed by the fecal discharges only, has been taught and accepted so many years, that it is not at all impossible that when searching for the cause of an outbreak of this disease, especially in so-called sporadic cases, the fact has frequently been lost sight of by the investigator, that there might possibly be some other mode of infection, or if this did seem possible it would be a bold person who would dare to assert that such was the case, contrary to the general accepted theory.

Comparatively recently it has been demonstrated that the typhoid bacilli are present in the urine of about 25 per cent. of those having typhoid fever, after the third week, and that such continues to be the case months after recovery has taken place.

Disinfection of the stools of persons having this disease has been so long and thoroughly taught, that it has become considered almost criminal for the laity to neglect this precaution, and quite so for a medical man to fail to give full directions for the proper treatment and disposal of this material.

With the typhoid bacilli present in the urine for months after the patient has passed from the observation of the physician and has resumed his usual avocation, how probable it is that many of the cases that have had their origin sought in vain, were due to the fact that infected urine had been deposited in the vicinity of some wells or water courses. Outbreaks of typhoid fever due to this cause have been recorded.

The opinion is gaining ground among those of large experience with typhoid fever, that personal contact is an important element in distributing the infection. This is especially so among the poor and those living in overcrowded and poorly-ventilated rooms. Within the past two or three years several observers have presented evidence to substantiate this theory. At the present time the writer is cognizant of several cases of typhoid fever among the nurses of a well-regulated institution that seem to have had their origin from personal contact with a sister nurse who has the disease. These nurses have not had the care of the case, but have frequently visited her. All the ordinary precautions have been observed and none in

the institution have contracted the disease, except her intimate friends, yet the same supplies are served to over a hundred persons. Experience shows that this mode of contagion is not probable in large and well-ventilated rooms and is an argument for hospital care of those suffering from typhoid fever, who reside in thickly-populated and unsanitary districts. It is not improbable that many of those who have had this disease after having cared for others who have been sick with the complaint, have received the infection by personal contact rather than from carelessness on their part in handling the material known to be infected.

Within the past few years important efforts have been made to produce immunity to typhoid fever by vaccination. Dr. A. E. Wright of the English army has made and published the results of extensive experiments by vaccinating nearly three thousand soldiers at various stations in India. The vaccine material was a lysolized (1 per cent. lysol) culture of virulent typhoid bacilli. This had been sterilized by exposure to a temperature 60° C., destroying the bacteria or lowering their vitality to such an extent that they would not produce fresh toxins in quantities sufficient to cause death when introduced into the human system. Dr. Wright describes the symptoms produced by the vaccine as follows: Headache, perspiration, pyrexia, pain both local and general, sometimes nausea and vomiting, looseness of the bowels and chilly sensations. These symptoms are at their height in about twelve hours, and have passed in from thirty-six to forty-eight hours. The person inoculated should remain in bed until these symptoms have passed.

Of eleven thousand two hundred and ninety-five under observation, two thousand eight hundred and thirty-five were inoculated. Of this number, 0.95 per cent. contracted the fever and 0.2 per cent. proved fatal, while of those not inoculated 2.5 per cent. developed typhoid fever and the deaths among those were 0.34 per cent.

A large number of men in South Africa were given preventive treatment with gratifying results. According to official statistics published by Wright of the results obtained in the military garrison at Ladysmith, of ten thousand five hundred and twenty-nine men that were not inoculated, 14 per cent. contracted typhoid fever, while of one thousand seven hundred and five that were vaccinated, only 2 per cent. had the disease. The death rate among the inoculated and uninoculated was practically the same.

The results of the attempts at artificial immunization against typhoid fever, so far obtained are very gratifying, and those interested in the prevention of this dreadful disease will await with impatience fuller reports.

Dr. Frank Billings of Chicago says in the Journal of the American Medical Association:

"The production of artificial immunity from typhoid fever, as a prophylactic measure, by inoculation with typhoid cultures, has been practiced with apparent success. The inoculations, however, are still too few and the results on man too indefinite to allow of positive deductions. Enough has been done to prove the harmlessness of the operation and to encourage a continuance of the practice."

REPORT OF COMMITTEE ON DISINFECTANTS AND DISINFECTION.

By HIBBERT WINSLOW HILL, M. D.,
Acting Chairman, Boston, Mass.

Professor Robinson, chairman of this committee, whose absence we all regret, has asked me to take charge of the report.

The excellence of that rendered last year is excuse enough for making it brief this year.

I shall submit therefore merely the reports sent to me by the chairmen of the sub-committees into which the committee as a whole was divided, a sketch by Dr. Doty of quarantine regulations in yellow fever as modified by the recent mosquito theory of infection and certain abstracts from the paper by Major Walter Reed, which, by prearrangement, were designed to furnish the committee with information on this point. Disinfection has long been practiced in yellow fever, although for more than one hundred years some acute observers have held that the danger from yellow fever is from light cases, rather than from infected goods, etc. The disinfection of ships carrying or exposed to yellow fever was and is therefore a point of great importance—in the past because it was believed necessary, in the present because our beliefs point to it as superfluous. But while your committee feels it a duty to record themselves, so far as present evidence allows, on this matter, it believes also that in relinquishing disinfection as directed against a hypothetical infective agent in this disease, capable of transmission through fomites, it should endeavor to record the precautionary substitutes for disinfection which may now take its place.

An immense amount of work has been done in searching for an ideal agent to destroy the pathogenic bacteria in excreta, moist and dry, adherent to clothing, furniture, etc. Some few excellent disinfectants we know, at extremely low prices. A whole host of disinfectants for which high claims are made, at all sorts of prices, are brought to notice every year. It becomes our duty to know what these disinfectants are and what they will do, but it is equally important that we should, for practical purposes, know what they will do for a given cost. So far as germicidal properties alone are concerned, no disinfectant can do more than kill quickly all pathogenic bacteria under all conditions. The best germicide is that which will kill the largest variety of pathogenic forms in the quickest time under the most varied conditions. Of this there can be no question. Beyond this point,

however, must be taken into account, injurious effects on the human, on animal life, on general property, and beyond this again, disagreeable effects, pungent odors, etc. Finally, convenience in handling, stability of composition and cost are to be considered. It would appear from this that there is a wide field for choice, but as a matter of fact, most of the new disinfectants offered from time to time, possess some feature which is strikingly prohibitive, while our present armamentarium, although not perfect, gives sufficient range of availability to meet most requirements.

We should, as a committee, discourage the constant exploitation of household disinfectants that do not disinfect, or do so at an unnecessarily high cost, while we welcome every attempt to produce at reasonable prices, any new disinfectant of greater range, convenience and comfort in application. I think it would be well for us to adopt as a standard method for treating new disinfectants which are submitted for examination, direct parallel tests with known disinfectants, taking dilution and cost into account, and to make statements for publication only such as "better than" or "not so good as" such and such a known agent in definite dilution. We have long since reached the limit on effectiveness of germicidal power. It is on other qualities, especially concentration, convenience, comfort and cost that we may expect improvement.

But setting aside this question, which is a laboratory question largely, it may be well for the committee to consider more fundamental questions connected with its subject.

There is, I think, a growing belief that disinfection of rooms, etc., is not an important factor in the restriction of disease in modern civilized life. Asepsis has taken the place of antisepsis to a great extent in surgery. The first step was the recognition of the bacteria as producing trouble, the next the effort to kill them *in situ*, the next to prevent at once their access and the necessity for killing them. Parallel with this change, I think the impression is growing that what we need now is not so much disinfection to kill the bacteria after they are spread about, but measures to prevent their spread. We are, and very properly, teaching the restriction of infection at the outset, the immediate segregation and destruction of infective matter rather than its distribution and subsequent attack. Of course, it will not do to push the analogy too far. I merely wish to outline an idea, not to construct a complete thesis.

Finally, it is a matter for us to consider if it may not be that sometimes routine disinfection work is misdirected. What proof have we that any appreciable percentage of diphtheria, for instance, is conveyed by fomites? What we know of the diphtheria bacillus tends to

make us skeptical that transfer in this manner occurs in any considerable number of cases.

It is indeed true that communicable disease is sometimes conveyed from sick to well by a third person, but probably it is by means of growing bacteria in the person rather than by those clinging to the clothing. That the throat of the intermediary in diphtheria is so infected we know. When disease recurs in an infected house, is it not more reasonable to suspect that the disease germs lurk in the persons of the inmates rather than in the furnishings of the rooms?

While not denying the possible agency of material things in the transmission of these diseases, it is believed by some close observers that the part thus played is very small. It is probably infected persons, not infected things, that cause the trouble, and it is infected persons who are practically well that are by all odds the most important factor.

In scarlet fever, it is considered from clinical evidence that fomites convey the disease more often and more markedly than in diphtheria. But the recent history of yellow fever must weaken everyone's faith in purely clinical evidence of modes of fomital infection. No more valuable subject can occupy the time of this committee than the re-examination for each disease of the evidence that disinfection is necessary and the redetermination of the exact fields of its usefulness in each case.

The committee will, I hope, endeavor to reinvestigate this important subject and will welcome any contributions which other members may make, of direct evidence, statistical or experimental, of the necessity for disinfection in the ordinary infectious diseases.

General impressions do not count for much, but clinical facts properly collected and analyzed may have as much scientific value as laboratory work. If every health officer would record the recurrence of communicable disease in an infected house, noting all the facts in regard to time, disinfection, persons infected and so forth, we might determine quantitatively the necessity for disinfection.

In conclusion, I wish to make clear that it is not the purpose of what has been said to shake existing faith in disinfection and disinfectants, but rather to point out the possible advantages that may come from a re-examination of the question. If such an investigation confirms present belief and practice, no harm will be done; if it results in lessening the amount of routine disinfection now performed or in directing it into more efficient channels, a great advantage will be gained. The suggestions made are not my own. The general drift of opinion, I think, particularly of those expressed by Dr. Chapin in his recent work on Municipal Sanitation, Dr. Doty and others, is in this direction, and I wish to acknowledge my indebtedness to the former for many valuable hints and much information.

REPORT OF SUB-COMMITTEE ON STANDARD CULTURES AND THE METHOD OF USING THEM.

By E. H. WILSON, M. D., Chairman.

The sub-committee on "Standard Cultures and the Method of Using Them" desire to report progress, and to refer to some of the work done along the lines laid down in the preliminary report of last year. The report of last year was not published in full, and it will be quoted in part in the present report which must still be considered a preliminary one.

It is realized at the outset that it will be necessary to select some disinfectant as a standard and to decide upon one or more organisms to standardize against it.

The disinfectant chosen should be one in common use, should be capable of destroying bacterial life, should be of definite chemical composition, readily determinable by chemical analysis, should be stable and readily obtained in a pure state.

The disinfectant which seems best to meet these requirements is mercuric chlorid; it is one which has been in use for many years, its disinfecting power is greater than that of any other in general use. It can be obtained in a state of great purity and its solutions, if properly preserved, are stable.

The culture chosen should be as constant as possible in the degree of its resistance to the disinfectant. This point cannot be determined in the present state of our knowledge and will have to be decided as the work progresses.

The organism chosen should be one, preferably of a pathogenic species which is easily obtainable, which is neither very resistant nor very sensitive, and one commonly met with in practical disinfection. The choice of the organism is not so readily made as that of the disinfectant, and it is probable that an extended series of experiments will have to be made before one, or at most two species, and of these species, individual cultures, can be decided upon. It has been thought best, therefore, to arbitrarily select one organism as a basis for these preliminary experiments and if available data regarding the constancy of resistance can be obtained, to use this organism in future work. We have chosen for this purpose two cultures of the staphylococcus pyogenes aureus.

The next question which presents itself is, whether it is better to have a standard solution of the disinfectant and vary the time of exposure, or to have a fixed time of exposure and vary the strength of the solution. It would seem more in accord with common practice and more practical in application to have a fixed exposure and vary the strength of the disinfectant. This should be as short as possible to

conduct the proper manipulations and to secure uniformity in results, on account of economy of time.

SCHEME.

1. To determine, as accurately as possible, the resistance of the standard culture to the standard disinfectant, and to determine the limits of error due to variability in the culture.

2. To determine the resistance of various other pathogenic bacteria to the standard disinfectant in terms of the standard culture.

3. To determine the disinfecting value of various disinfectants, in terms of the standard disinfectant.

THE AGE OF THE CULTURE.

A culture maintained under uniform conditions will be more likely to show uniform resistance than one not so kept. It is therefore proposed to keep the culture on plain agar at 37 C., renewing it every day, and using for the experimental work, a 24-hour culture.

METHOD OF EXPOSURE.

In order to secure actual and accurately timed contact between the disinfectant and the organism to be tested, various methods have been used. The use of infected silk threads is a common method; infected cloth, the exposure of solid cultures, the mixing of broth cultures with the disinfectant, and the use of glass and rubber have all been tried. It would seem that in order to present the organisms to the disinfectant in as isolated condition as possible, and to avoid side reactions caused by the admixture of culture media and disinfectant, the use of some indifferent substance, such as glass, would be advisable.

TIME OF EXPOSURE.

Experiments seem to show that the necessary manipulation can be performed in ten minutes, but inasmuch as the thickness of the layer would probably exert a deciding influence on the necessary time exposure, ten minutes has been provisionally adopted for these preliminary experiments.

TEMPERATURE OF THE EXPERIMENT.

In order to insure as great uniformity as possible, it is necessary that all experiments be conducted at the same temperature. A temperature of 20 C. has been provisionally chosen as conforming closely with conditions existing in actual practice.

LIMITING THE EXPOSURE TO THE ACTUAL TIME INTENDED.

The action of the disinfectant ceases only when it is either removed or rendered innocuous. It has been shown that mercuric chlorid forms with bacteria a substance which is not removed by washing in water; it is therefore necessary to use an agent to render it inert. It has been shown that ammonium sulphid, which has no inhibiting action in dilutions still sufficient to produce complete precipitation, precipitates mercuric sulphid which is inert.

DURATION OF INCUBATION OF TEST CULTURES.

Bacteria which have been exposed to the action of disinfectants, and the vitality of which has not been entirely destroyed, often requires considerable intervals of incubation after transplanting, to show perceptible growth. In order to secure uniformity in this respect, we believe that seven days at 37 C. should be allowed before a negative result is recorded.

CHOICE OF SPECIES.

After the first problem in the above scheme has been worked out, it would be advisable to extend the work to the second. While for purely sanitary work, the choice of species would naturally fall among the pathogenics, it seems necessary, in order to extend the method to agricultural and other work, that some one or more of the putrefactive forms be thus standardized. For the present it seems important to standardize several of the most important of the pathogenics.

The ultimate object of the whole work is to determine the value of the different disinfectants, and the strength of each necessary to accomplish the result. The first two problems are necessary preliminaries to this. This brings out the probability that variations in technique will be required for each disinfectant, which it would require an extended series of experiments to define. This would tend to bring out the conditions best adapted to each disinfectant in its application. It must be remembered that the results obtained by the above methods apply only to bacteria and fluid disinfectants, and do not have any bearing upon side reactions which are known to materially influence the value of disinfectants. Much work has been done on the extent and importance of these side reactions, and much more must be done to place the data upon a systematic and available basis. The further investigation of these side reactions is really a secondary or supplemental work, and can be left for the future.

The same organism (staphylococcus pyogenes aureus) was used and the same disinfectant (mercuric chlorid) was taken as the standard disinfectant. The standard culture was one kept on plain agar at 37 C.,

renewing it every day and using for each experiment, cultures 24 hours old. One of the greatest difficulties encountered was that of securing uniform results in the way of growth in different series of exposures of the same interval; and it appeared that some modification of the method of exposing the bacteria to the disinfectant was necessary. The method used was that suggested by Hill, of infecting glass rods with the organism to be tested, by rubbing the rods on the surface of an agar culture, allowing them to dry, then exposing them to the disinfectant, washing them in ammonium sulphid, placing them in tubes of bouillon and incubating for a week. It was soon found that discordant results were obtained, and were probably due to the varying thickness of the layer of bacteria on the rod. Comparative experiments were made by infecting the rods with solid cultures, bouillon cultures and by emulsions made by scraping the growth from agar cultures and making the emulsion in sterile water. Better results were obtained by the use of the rods infected with the emulsions, but even these results were not perfectly uniform.

Inasmuch as many difficulties were encountered in the use of the glass rod method, as the results obtained in many cases were evidently inaccurate and unreliable in spite of the extreme care used in making the experiment, and as the cause of the inaccuracy seemed to be connected with the thickness of the film of bacteria on the rod, a method was devised, the object of which was to obtain the most intimate contact possible between bacteria and disinfectant, and at the same time to avoid the introduction of any extraneous substance which could in any way influence the reaction.

The method is as follows:

1. Long necked three-inch funnels, each containing a 9 cm. Schleicher and Schull No. 590 filter paper, were capped with halves of Petri dishes and sterilized at 140 C. for one hour.

2. From a 24-hour agar culture an emulsion of bacteria was made by transferring the growth on the agar surface as completely as possible to a large tube containing 50 c. c. of sterile distilled water. If more emulsion was needed, two or more of these tubes were made up, using one agar tube for each 50 c. c. This emulsion was thoroughly shaken and filtered through one of the filter papers mentioned above. The object of this procedure was to furnish a homogeneous emulsion free from lumps. Any agar which might have been transferred was also thus removed.

3. Solutions of mercuric chlorid of various strengths in distilled water were made. The usual solutions were 100, 200, 400, 800, 1600 and 3200 litres. That is, an amount of mercuric chlorid equivalent to its molecular weight in grams was dissolved in the amounts of water

given above. These solutions were kept in glass-stoppered bottles in the dark.

4. Five c. c. of the emulsion described above was transferred by means of a sterile pipette to a sterile tube, and 5 c. c. of the disinfecant run into it from another pipette, the two solutions mixed as rapidly as possible and allowed to stand for twenty-eight minutes at 20 C. At the end of this time the end of the tube was flamed and cooled, and the mixture poured on to a sterile filter paper, the top of the funnel being immediately covered again with its glass cover. While this exposes the mixture to the air momentarily, yet the exposure is no greater than is given to a Petri dish when its cover is removed.

5. The paper is next washed twice with freshly sterilized distilled water to remove as much as possible of the mercuric chlorid. Control experiments show that a paper can be washed at least forty times with water and still retain bacteria enough to give a prompt growth when inoculated into a broth tube.

6. When the disinfectant has been in contact with the bacteria exactly thirty minutes, the filter paper is carefully washed three times with dilute ammonium sulphid (10 per cent. of the commercial article). Control experiments show that forty washings with a solution of similar strength cause no appreciable inhibition.

7. The paper is next washed with water twice to remove the excess of the ammonium sulphid, the paper carefully removed from the funnel with sterile forceps, the point cut off with sterile scissors, and dropped into sterile broth and allowed to incubate for seven days.

This method has the obvious advantage in that the contact between the bacteria and the disinfectant is much more perfect, and no preliminary drying of the bacteria is necessary. There can be no question that such drying would be harmful to sensitive species like cholera. It has the disadvantage of exposing the cultures more to the air, making the possibility for contamination greater. Whether this would be frequent enough to become troublesome can only be determined by experience. The method has only been in use a short time and but little work has been done on it.

Exception might be taken to the use of filter paper on the ground that the action of the disinfectant would be modified by it. It is not thought that this would be the case. The mixture containing bacteria and disinfectant is only in contact with the paper for a very short time, usually less than a minute, before it is washed with water and with ammonium sulphid, which immediately stops the action of the disinfectant. The paper used is washed in hydrochloric and hydrofluoric acids. It consists of practically pure cellulose and is probably entirely inert, at least as inert as glass.

Not enough experiments have been made by this method to determine accurately the dilution required to kill staphylococcus pyogenes aureus in thirty minutes under the conditions stated above. Our results show that this point lies in the neighborhood of an 800 l. solution, that is 5. c. cm. of a 400 l. solution plus 5. c. cm. of bacterial emulsion.

A word may be said in favor of expressing strengths of solutions by the method given above instead of by percentage composition or any other way. Kronig and Paul (Zeit. f. Hyg., Bd. 25, Heft. 1) first called attention to the advantages to be derived from a comparison of equimolecular solutions when different disinfectants are used. This method of comparison is so frequently used in all sorts of chemical research involving the use of solutions, and so many hitherto unsuspected and important relationships have been discovered in this way that the advisability of adopting such a method can hardly be questioned.

Since the work detailed in the foregoing report was done Paul (Zeit. f. Angewandte Chemie, 1901 s. 333-344 and 357-368), has called attention to the method first described by him and Kronig in 1896, and has published some very important conclusions drawn from their work. This work has been of a very elaborate and painstaking character, and has extended over a number of years. The results obtained by their method seem to indicate that a trial of it would be desirable in this country, and, if time permits it is our intention to work at it in the near future.

OBSERVATIONS ON THE PRACTICE OF DISINFECTION IN THE FEDERAL DISTRICT OF MEXICO.

By Dr. FERNANDO LOPEZ, Mexico, Mexico.

All students of hygiene are now of one mind in admitting that disinfection is the most powerful method that can be employed for the prevention of the development and propagation of infectious diseases, and that it is efficacious in proportion to the promptitude with which it is applied and the perfection of the means employed.

The problem of disinfection as regards the contaminated localities, furniture and utensils, is one that can be easily and perfectly solved by the sanitary authorities, and it may be said that this is done in the Federal District in a very efficacious manner. The staff that is dedicated to this purpose is sufficiently numerous for the requirements of the service, and can always be increased in case of necessity; whilst the instruction which it is constantly receiving places it in a condition to render good service. and it is also equipped with all the apparata and utensils that are required for its purpose.

The method usually employed for the disinfection of houses, is by the atomization of solutions of bichloride of mercury at 2 per cent. over the walls, ceilings and pavements, after the dust has been collected by means of cloths that have been dampened in the same solution. In some cases, we also employ a 5 per cent. solution of carbolic acid and formaldehyde.

The apparatus now in use are atomizers of the Japy system, the mixers of the dosimetric system of Lauranse, made by Geneste & Herscher, and the formaldehyde generators of the Sanitary Construction Company.

The disinfection of the furniture and utensils is carried out by rubbing them with cloths or brushes that have been impregnated with a solution of bichloride of mercury, when the objects are not liable to suffer damage from that substance, but when they are of a delicate nature we employ other solutions, such as creoline, carbolic acid, formalin or formaldehyde. These same methods are employed for the disinfection of coaches, railroad cars, etc.

The dangers of propagation through contaminated clothing are much more difficult to avoid, in view of the necessity of their frequent washing, a work that has to be either done at home or in the public wash houses. In the former case the danger is not so great, as the

clothing does not leave the patient's house; but we cannot say the same in the latter case, in which the clothing is carried without any precaution whatever to the washerwoman's house and from thence to the wash house, mixed with the uncontaminated clothing, washed in the same water which is a vehicle that greatly assists the distribution of the germs and thus establishing a real danger and focus of propagation of infectious disease.

In the City of Mexico, the contaminated clothing is not collected for disinfection until the sickness has terminated, and the dwelling is disinfected, for which reason the dangers above enumerated still exist. Special instructions have been printed and profusely distributed, recommending amongst other things, that the clothing which is taken off the patient should be immediately introduced into a 1 per cent. solution of bichloride of mercury and not sent to the wash until it has been left soaking in that solution for some time.

This method would be of great service, if we could have the certainty of its being carried out in all cases; but as it is not possible to overlook its fulfillment, and experience has shown us that such rules are rarely observed, I consider it indispensably necessary to adopt some more efficacious method. For want of a better, this might be made to consist in requiring that all the public wash houses should subject all clothing to a boiling in a weak solution of some salt of soda or potash before they are washed.

The clothing which is collected by the agents of the disinfecting service is immediately enclosed in canvas bags and transported in closed wagons to the disinfecting plant, where they are submitted to a high steam pressure.

Not satisfied with the present disinfecting station, and convinced of the necessity of equipping the city with better means of defence, in view of the increase in the population, our government has supplied the necessary funds for the establishment of a new department of disinfection, which will be shortly opened in the Plazuela de Montero, towards the northwest quarter of the city.

In this new building, which is now being constructed, two steam disinfecting stoves will be erected to work under high pressure, of the system invented by Ferdinand d'Hetre of Paris, which have already been received. One of these stoves is of the model which is known under the name of "Laveuse Desinfectieuse," which allows the clothing to be washed in a rotating cylinder that works inside the stove, and disinfects the clothing immediately by steam under high pressure.

As can be seen by the annexed table, which shows the number of disinfections that have been made during the last five years, these have been greatly increased during the last year, thus rendering it indispensable to open a new station.

Some of our hospitals are equipped with disinfecting apparatus, of which the one in the military hospital is worthy of note, as it possesses a steam laundry and a steam disinfecting stove that works under high pressure, made by Richard Kny of New York. It is also equipped with formaldehyde generators and atomizers for the use of the barracks and other military establishments, and remarkably good results have been derived from the use of these appliances in preventing the development of infectious diseases in the garrison of the city.

The disinfection of the excreta of the patients cannot be overlooked by the sanitary inspectors, but the public is instructed on the subject by the published rules I have above referred to, which advise the use of a 5 per cent. solution of sulphate of copper to be previously deposited in the vessels, so that this solution will receive them, after which they are at once thrown into the closets.

For the disinfection of the closets and drains, we have recommended the use of 5 per cent. solutions of sulphate of copper or iron, and lime water.

It is very difficult to look after the cleanliness of the patients during their convalescence and before they leave their dwellings, with the risk of spreading the disease in other parts, and we find ourselves obliged to confine our efforts to recommending the use of baths, under medical advice.

For the purpose of facilitating the personal cleanliness of the poor classes, we have opened some baths next to the disinfecting station, with shower baths and warm water, which can be taken advantage of at very low prices, and suit the public taste because they are both agreeable and hygienic. Baths of this character have for a long time been in use in the military hospital, which has an average of 500 patients, and where from 12,000 to 15,000 baths are given every year.

The General Hospital of the City of Mexico, which will shortly be completed, will also be equipped with a disinfecting plant and baths of the most perfect pattern that is known up to date.

DISINFECTIONS PRACTICED IN THE CITY OF MEXICO DURING THE LAST FIVE YEARS.

Year.	Houses.	Rooms.	Aricles of Clothing.
1896	1481	2765	19,685
1897	2520	3740	29,871
1898	2305	3382	34,113
1899	1850	3055	30,347
1900	2047	3085	37,665

REPORT OF THE COMMITTEE ON PUBLIC HEALTH LEGISLATION.

By U. O. B. WINGATE, M. D., Milwaukee, Chairman.

The last report submitted by this committee was a brief one presented by myself in the absence of Dr. Walcott, who was then Chairman, at the meeting of the Association in Ottawa in 1898. That report was very brief and related what had been done by way of creating public interest in what is known as the "Spooner Bill." This bill provides for the creation of a bureau, to be known as a National Commission of Public Health, in the Treasury Department, this Commission to be under the supervision of a Commissioner of Public Health, who shall be a physician and experienced sanitarian appointed by the President of the United States, or by the Commission if such is possible, and an Advisory Council consisting of one member from each State and Territorial Board of Health, and from the medical corps of the Army, Navy, and Marine Hospital Service. This Advisory Council is to meet once or twice a year in Washington, but it provides for an executive committee consisting of nine members of the Commission, of which the Commissioner, a representative from the Army, Navy, and Marine Hospital Service, will be ex-officio members, the remaining five members to be elected by the Commission at the annual meeting, which shall be convened by the Commissioner whenever in his judgment public interests shall so demand it, and this executive committee shall have full power to act.

It has been suggested that if a new department is created by Congress which shall have charge of the commercial interests of the country, that this bureau, together with several others, will be placed under the supervision of this department.

During the past two sessions of Congress practically nothing has been done, except that this bill has been referred to a special committee of the Senate of which Senator Spooner, the author of the bill, is the chairman, and I am informed by Senator Spooner that he will do his utmost to have the bill passed by Congress during the next session.

There has been a sharp opposition against this measure by the Marine Hospital Service and its friends, but there is also great objection to making a department of public health out of the Marine Hospital Service, for the reason that that service has already all that one man should have charge of. Moreover, it is the belief of a large number

of physicians and sanitarians throughout the country, as well as business organizations, that a department or bureau of public health should be a bureau by itself and not organized in connection with any other department or service, and that a Commissioner of Public Health should have no other duties to perform than those of such bureau.

It is believed by your committee that more effort has been put forth to favor the "Spooner Bill" than any other measure of its kind that has ever been introduced into Congress. Perhaps the most important work along these lines was done by the New York Board of Trade and Transportation, which body took a very lively interest in the matter at the time the bill was introduced, and I have been repeatedly informed by the secretary of that body that they are still as much interested as ever, and will do anything they can to further the interest of the bill. Your committee has also been informed that the business men of Boston are working along the same lines. A few years ago this New York Board of Trade and Transportation appointed a special committee to investigate existing conditions, and that committee spent four months of time in careful study and inquiry, and submitted its report in 1898. It addressed personal letters of inquiry to nearly 1000 professional men, sanitarians, and men engaged in transportation and commercial pursuits. These inquiries were directed mainly to "quarantine status and administration in foreign countries; the present status of quarantine in the United States; legislation needed for lessening injury to the restrictions on commerce and travel, and to afford greater security to the country; and the power of Congress under the Constitution to regulate matters affecting the health of the people."

Only thirteen of them endorsed the proposition to enlarge the powers of the Marine Hospital Service, or in other words to make a public health department out of that service. A very large majority of the replies expressed the opinion that "the National Government can never hope to create a successful National health organization based upon the Marine Hospital Service as a nucleus, because in many states the bitter hostility to the Marine Hospital Service, engendered by its own acts, is so formidable as to preclude any possibility of harmony between it and such state and local authorities." The opinion was that "to give the Marine Hospital Service still more arbitrary powers, as is proposed by making that service a department of public health, without the obligation to consult or in any way regard the local authorities, would only widen the breach, intensify the bitterness and render resort to force necessary to carry out its regulations." "The 'Spooner Bill' meets in full accord with the most enlightened

modern views of health protection. It does not abolish quarantine, but in time would bring about conditions which would make quarantine almost unnecessary. It recognizes several departments of the National Government, and every state and territory as interested and important factors in the scheme of health protection, and gives to each a voice in the framing of health regulations, and this is done by means of organization so simple as to be immediately moved to action in emergencies. It removes friction and hostility and promotes harmony and co-operation, which are essential to the success of any National health law, and it violates no principle of National or local policy."

"The committee went over the ground with the greatest deliberation, and though their views upon taking up the question had a decided leaning toward the proposition to give the Marine Hospital Service the absolute and arbitrary power it asked for, they finally and harmoniously reached the opinion that such a course would be a serious injury to the people of the United States by delaying and hindering the broader and better and more certain solution of the problem which the 'Spooner Bill' will afford." They also recommended the "Spooner Bill," with certain amendments which it is understood "that Senator Spooner and the friends of the bill will accept, for passage." This board has done a great deal of work. Their service certainly should be recognized, for it comes from a source which includes practically the business interests, so far as transportation is concerned, of the whole country.

During the past year the Chamber of Commerce of Cleveland, Ohio, has sent out the draft of a bill, which practically embodies the provisions of the "Spooner Bill," except it makes the Supervising Surgeon-General of the Marine Hospital Service the Commissioner of Health, and leaves out some very vital points contained in that bill. The objections to the scheme of the Cleveland Chamber have been pointed out to them, which are, as has been stated, the creation of a bureau that shall be attached to any other service, and also the defects in their bill pertaining to various matters which are contained in the "Spooner Bill." What the final result will be of the deliberations of the commercial body at Cleveland your committee knows not.

Your committee regrets exceedingly to take any course that would be obnoxious to the Marine Hospital Service, and it submits this report with the most friendly feeling to that service, recognizing the great value of the work that it has accomplished during the past few years, and it would not in any way favor any scheme that would interfere with the primary functions of this service as it was originally created, but as already stated, it does not believe that a National Pub-

lic Health Department or bureau should be attached to any other department, or bureau, or service, nor be under the supervision of one who has charge of another great service. Your committee believes that the "Spooner Bill" should become a law, and that the efforts of all sanitarians should be put forth to accomplish this end, and that by united action on the part of this body, together with the leading sanitarians and business organizations of the country, this end can be accomplished in the near future.

REPORT OF COMMITTEE ON SCHOOL HYGIENE.[1]

By HENRY MITCHELL, M. D., Chairman, Trenton, N. J.

In recognition of the value of the work already accomplished in several of the leading cities of the United States in tracing out sources of infection among pupils in the public schools, the American Public Health Association, at the annual meeting held in Indianapolis, in September, 1900, created a Committee on School Hygiene, with the purpose of securing the presentation from year to year of reports showing (1) the progress made in the application of measures designed for the early detection of cases of communicable diseases among public school pupils; (2) for recording their physical development, and (3) for the improvement of sanitary conditions on school premises. Your committee has deemed it unwise to endeavor at this time to investigate all of the questions involved in these subjects, and they have limited the inquiries for this year to the medical inspection of schools.

In order to obtain facts upon which a report could be based, letters requesting information were sent to the executive health officer of each of the States of the Union, to the Superior Board of Health of Mexico, and to the central and provincial health officers of Canada. The following letter was sent to the superintendent of public instruction of 450 cities:

Dear Sir: Will you have the kindness to inform the Committee on School Hygiene of the American Public Health Association, to what extent medical inspection of schools has progressed in your city?

1. Have medical inspectors of schools been appointed?

2. If so, please state the number of inspectors employed, and send to us copies of the regulations or ordinance under which the work has been carried on.

3. Kindly refer us to any reports or papers which have been published, showing results thus far reached in conducting the work.

Very truly yours,

Henry Mitchell,
Chairman Committee on School Hygiene.

One hundred and fifty-four replies have been received to the foregoing letter of inquiry, and they have been summarized as follows:

Canada.

Province of Ontario. A communication from the Provincial Board of Health of Ontario states that "in a number of instances examination of school children and the following to their homes of absentees

[1] To bring this report within the limit prescribed by the Association it has been much abridged.

from school has been practiced, in order to obtain exact information of cases of real or suspected disease in school children. The results have been remarkably successful, as when carried out thoroughly, outbreaks have been again and again suppressed within the shortest possible time. The work will grow, as municipalities realize that it is at once effective and, in the end, economical."

CONNECTICUT.

New Haven. F. H. Beede, superintendent of schools, states that medical inspection in the public schools "was introduced February 1, 1901. At that time five young and reputable physicians volunteered their services as medical inspectors of the public schools. The city was divided into districts and each inspector placed in charge of a district. Each morning, after the opening exercises, it is the duty of each school principal to find out whether there are any cases of sickness which need the attention of the medical inspector. If there are, notice is sent to the office of the inspector and he immediately visits the building. The inspector is authorized to send home any pupil whom he thinks, for reasons of health, should not be in school. The inspector is not allowed to prescribe in any case, but, if he thinks best, he sends word to the parent advising that the family physician be consulted. It is probable that we shall make an exception in this matter, allowing a general prescription for pediculosis. Thus far the work of the inspectors has been of much value, and I hope it will not be discontinued. It is probable that next year, or later, the city will make an appropriation for this work.

DISTRICT OF COLUMBIA.

Washington. A. T. Stewart, superintendent of schools, says: "Medical inspection of schools has been recommended by the board of education of this District, but as yet no provision has been made by Congress for carrying same into effect."

ILLINOIS.

Chicago. Following is an extract from the annual report of W. L. Bodine, superintendent of compulsory education, 1900:

In January, 1900, fifty medical inspectors of schools were assigned to work under the jurisdiction of this department and technical direction of the Department of Health. From January 8th to April 15th, 1900, the result of their work in protecting the health of pupils at the various schools was as follows:

Total number of examinations	76,805
Contagious diseases detected and excluded	4,539

The emergency corps of inspectors on duty from April 17th to June 1st, 1900, conducted 60 additional examinations and excluded 35 children from school for cause.

Out of 76,805 examinations only one lawsuit instituted against the Board of Education by parents resulted, and in that instance Judge Ball of the Superior Court decided that the medical inspection of schools was constitutional and the rights of principals and medical inspectors to exclude pupils for cause were upheld. The case was never appealed.

Medical inspection has proved a great safeguard for the health of the children in Chicago public schools. The service has been handicapped by a limited number of inspectors and an inadequate appropriation to increase the force. By increasing the force the service could be improved, as inspectors now have too many schools to look after in their sub-districts. Credit is due medical inspectors of schools for their diligence to duty, for their diplomacy and general proficiency. This report demonstrates that their service has materially reduced the prevalence of diphtheria, scarlet fever and kindred diseases of childhood in the public schools.

I would respectfully suggest that health of pupils could be further protected if sanitary inspectors were appointed to regularly visit school houses and inspect the sanitary condition of buildings. In some of the rented quarters, particularly where the ventilation and general sanitary condition is bad, a system of vigilant inspection is necessary if the Board of Education desires to make the protection of health complete.

KENTUCKY.

Paducah. Medical inspection of pupils has not yet been adopted, but Superintendent C. B. Hatfield states that "a resolution is now pending to require physical examination of teachers before employment, to protect against tuberculosis."

MASSACHUSETTS.

Arlington. One medical inspector of schools was appointed January 1, 1901, but the service has not yet been fully developed.

Boston. Boston has the honor of being the first municipality in the United States to establish medical inspection of schools, which was begun, under the direction of the city board of health, in November, 1894. From the annual report of Edwin P. Seaver, superintendent of public schools of Boston, for the year 1900, the following is taken:

For five and a half years past our schools have received the benefit of regular daily medical inspection. Competent physicians appointed by the Board of Health visit all the schools soon after the opening of the morning session each day. Every class teacher reports to the principal, early in the session, on the condition of the children in the class. If any children seem to be ailing in any way the inspector's attention is called to them. He examines them. If a child is found to be ill, but without manifesting any symptoms of an infectious disease, the teacher is *advised* to send the child home, with a message, written or oral, as may seem best, stating what the trouble may be and suggesting, if medical care seems to be needed, that the family physician be called. The inspector does not declare his diagnosis of the case nor give professional advice as to its treatment. To do so would be to encroach on the province of the family physician, a thing which the inspectors are particularly required to refrain from doing. There are, of course, certain minor ills, pediculosis, for example, not requiring professional advice, for the treatment of which suggestions may be conveyed to the parents directly. Nor would the medical inspector refuse immediate treatment in cases of emergency.

In respect to all non-infectious diseases the medical inspector acts by permission of the school authorities as a friendly adviser. But if

he finds a child manifesting symptoms of an infectious disease he at once acts on his legal authority as an agent of the Board of Health; he *orders* the child sent home, and at once reports the case to the Board of Health. He follows the case home and sees that it is properly isolated there, or is removed to the hospital. Later, when recovery is reported by the attending physician, he makes another visit to determine whether all danger of infection has ceased, and whether the patient shall be released from isolation. In all this he is acting under the law and for the public safety.

The great advantage arising from his visits to the schools is the early discovery of symptoms of infectious disease among the children. Such early discovery and the prompt measures thereupon taken have resulted in putting a stop to epidemics that could easily have become, through neglect, widespread and disastrous.

Accounts of epidemics arrested in this way have been published in medical journals. From one such account, written by a medical inspector, I copy a few paragraphs to show how an epidemic of diphtheria was handled. It started in a first (lowest) grade primary class, and had made considerable progress before any cases had become known to the teacher or had been reported to the Board of Health. The inspector, noticing that the first two cases reported to him came from the same school, proceeded at once to investigate. He found the teacher already alarmed by finding on the Board of Health report for that morning two more cases of diphtheria from her class, by rumors of two or three other cases among the absent children, and by finding three cases of sore throat in the room. The inspector goes on to say:

It was at once apparent to me that we had an epidemic on hand. Four suspicious cases were sent home and recommended to the care of the family physician. The extent of the epidemic was investigated during the day; the Board of Health had arrangements made for disinfection at nine the next morning; the class was allowed to assemble for purpose of investigation, every throat being examined, and a culture taken in all suspicious cases; the class was then dismissed. This was on Thursday morning. After disinfection the room was cleaned up, allowed to air for two days, and opened for school again on Monday. For a week and a half the throats of all pupils present in the class were examined the first thing in the morning. No child who had any suspicious symptoms was allowed to return until a culture from the throat was found to be negative. As a result of these measures, notwithstanding the fact that the epidemic had made such good headway before discovery, not a single case of diphtheria developed after the epidemic was discovered except those known to have been infected at that time.

. . . . . .

How little protection would come by trusting to the parents of some public school children is shown by their action in the following cases: Four cases were sent home at the time of the discovery of the epidemic on the morning of May 5. They all had suspicious looking throats, and in view of the existing epidemic the diagnosis of diphtheria was warranted clinically. With each child was sent a note stating that there had been some cases of diphtheria in the school-

room, that the child had a sore throat that probably was diphtheria, and that the school inspector advised calling the family physician. The mother of one of the children brought him back herself in the afternoon and was abusive to the teacher for sending him home. I turned up just in season to get my share. I was informed that I did not know what I was talking about, that his nausea and vomiting and constitutional symptoms two days before were due to indiscretion in eating, that his sore throat was simply "tonsillitis," that he was subject to, and that the patches in the throat were of no importance. The other children might have diphtheria, but *her* boy didn't, "because he wasn't sick enough." She refused to let me take a culture, and was informed that the boy would not be admitted to the school until a negative culture had been obtained by myself, or if she preferred by her family physician.

The three other cases returned next morning. Two brought verbal messages that they were well enough to come to school. The third brought a note from his father saying it was absurd to say his boy had diphtheria. Cultures were taken from all three throats, and all proved positive. The mother of one of these was not convinced even then. She called another doctor to prove that the school doctor was wrong, and discharged him when he obtained a positive culture, and she was only partially persuaded there was no trick to it when a third doctor also found a positive reply to his culture.

One other case is instructive. This boy was subject to tonsillitis, so his parents did not attach any importance to a sore throat which began May 2. He returned May 5 and was examined. His throat was negative. I learned, however, that his brother who slept with him had a sore throat, beginning the day before, May 4, and had stayed at home, but that he also was at school that morning in another room. He was sent for, and I found several characteristic patches in his throat. Thus a possible source of infection of another class was nipped in the bud. Both were sent home with a note recommending the family physician, and stating what the probable trouble was. They did not consult a physician for ten days. Naturally the throats were cleared up then, and the physician, not understanding the full circumstances, gave them a note, stating that they might return to school. Admission was refused until a negative culture was found. They proved positive, and the one from the class-room which had the epidemic lasted positive for two weeks more. Had I allowed him to return without a culture he would have had two weeks in which to start another epidemic of diphtheria.

The same writer describes the suppression of an epidemic of scarlet fever which started with a pupil supposed by his parents to be ill with German measles, but found on investigation by the inspector to have scarlet fever.

In respect to infectious diseases, certainly the parents now have reason to feel that their children in school are much better protected than they would be without daily medical inspection. And as regards other diseases the earlier medical attention often secured in consequence of the inspector's visits is recognized as a great benefit. The masters of schools and the teachers have learned to depend upon

the advice of the medical inspectors in various matters relative to the health of pupils and the sanitary condition of the school-houses.

The return of pupils after an absence for sickness, the attendance of pupils living in the same house, but not of the same household, with a person sick with an infectious disease, the admission of pupils without certificates of vaccinaton, the fitness as to the physical condition of certain children to be pupils of a school, and defects in the ventilation and sanitation of the school-houses, are among the matters which receive attention from the medical inspectors, and concerning which they give advice. Generally speaking, such advice is gladly accepted and acted upon.

The services of the medical inspectors in the schools deserve public recognition, for they are rendered as the contribution of public-spirited citizens to the good of the community, or as aid to the advancement of medical knowledge. The salary paid is a merely nominal compensation for the service rendered; yet the Board of Health experiences no difficulty in finding "well qualified and discreet physicians" to undertake the duties of school inspection.

In a paper read by Edward M. Green, M. D., medical inspector of schools of Boston, before the Providence Medical Association, February 4, 1900, he says:

Medical inspection of schools, both public and parochial, was begun in Boston in the fall of 1894 and was secured only as the result of 4 years of persistent effort on the part of the efficient and progressive chairman of the Boston Board of Health, Dr. Samuel H. Durgin. The immediate occasion which made his appeals successful was the unusual prevalence of diphtheria in Boston during the year 1894.

The system of inspection is under the control of the Board of Health. The School committee cooperates cordially in the work, by giving permission for inspectors to enter the school buildings and examine pupils, and by directing teachers to watch for cases of illness and to bring them to the notice of the inspectors.

The masters and teachers appreciate the fact that this work is beneficial to themselves as well as to the pupils, and are anxious to coöperate in carrying it out. The parents see, with approval, that their children are safeguarded from danger, and from the general public nothing has been heard but commendation.

Inspectors are generally selected from the younger men in general practice, as they have most time to devote to the work. Many of them have been hospital internes. They must be interested in the work, discreet, and tactful, and it is desirable that they should live in the locality of the schools assigned to them. There have always been some homeopathic doctors among the Boston inspectors. The work has nothing to do with therapeutic systems, but requires only the ability to make accurate diagnosis. In establishing a work of this kind it is important to have the support of the whole community. Women physicians have not yet been appointed in Boston, but I am told they have been in New York. If otherwise qualified they would make good inspectors, especially in the higher schools for girls.

The number of pupils in the public schools of Boston is about 80,000, and there are about 13,000 more in the parochial schools. There are 250 school buildings, and 50 inspectors of schools, each doctor thus having 5 schools and nearly 2,000 children under his care.

The pay of inspectors in Boston is only $200 a year. Though the salary is small, the position is an honorable one, and likely to increase a young man's reputation though not his practice directly. Children are not allowed to go to his house in connection with school work, and any that he finds ill, are carefully directed to call in their own family physician, or, if poor, directed to a proper hospital.

A monthly report, filled out on a printed form, is required from each inspector. The report contains a list of the different diseases observed and the number of cases of each disease found in each school. It also records the number of pupils sent home; the number of vaccinations performed, the number of consultations with teachers in regard to such matters as sending children out of school for contagious disease at home, the determining when they may return to school, and giving advice to the teacher on any other subject. On the back of the blank forms there is printed a classified list of the important or common diseases. To secure uniformity and accuracy, the inspectors are requested to use this approved nomenclature in making their reports. Inspectors should familiarize themselves, if necessary, with the symptoms and appearances of all the diseases there mentioned. This involves, among other things, a considerable knowledge of diseases of the skin, which is not always possessed by the general practitioner. * * * *

An association of the medical inspectors has been formed which holds meetings from time to time, and is presided over by the chairman of the Board of Health. The objects of the association are: to make the men acquainted with each other; to establish an *esprit de corps;* to secure uniformity of decision on questions of school attendance, in order that children of the same family in different schools may be alike excluded, or admitted, after there has been contagious disease at home; to discuss the methods by which the contagion of diphtheria, and similar diseases, may be spread in the schools, the criteria for determining when the danger of contagion is ended, etc. The association has been addressed occasionally by specialists in diseases of the eye, ear, nose, and throat, etc., who have discussed the diseases of those organs which have especial importance in relation to our school work. * * * *

The inspector sees only those children to whom his attention is called by a printed slip on which the teacher has filled out the date, name of the child, the number of the school room, and the complaint which the child makes, or the symptoms which the teacher has noticed. These slips are filled out soon after the opening of school, and deposited in a convenient place where the inspector finds them. On his arrival at school, each child is sent out to him for examination. On each child's slip he records his own diagnosis, and his advice in regard to excluding the child from school or not, and any remarks he wishes to make for the information of the teacher. The child hands the slip to the teacher, and the latter sends it to the master, who is obliged to keep these slips on file, thus preserving in each school a record of all the illness that occurs there. An opinion can then be formed in regard to the relative sanitary condition of each building. Questions of drainage, plumbing,

heating and ventilation are not considered by the medical inspectors, but are referred for investigation to special experts of the Board of Health.

The children who come under our inspection may be divided into two classes: 1. Those who are subjects to contagious disease, and who must be excluded from school for the benefit of the other children. 2. Those who are suffering from noncontagious though perhaps severe and disabling disease, or who are mentally or physically below the normal standard. * * * *

The inspector should always have with him one or more of the diphtheria culture outfits, which are supplied by the Board of Health, and take a culture from every case of acute pharyngitis, or tonsillitis, which he sees. Many cases of diphtheria can be discovered in no other way. After a culture has been made, the child is sent home to remain until a report has been received from the laboratory on the following day. If a case of contagious disease is discovered the child's books are wrapped up in a bundle and sent to the Board of Health for disinfection or destruction, and the desk and seat are washed by the janitor with a strong solution of corrosive sublimate or formaldehyde.

If more than one contagious disease is found in any room every child is sometimes examined by the inspector. Clinical thermometers are never used, on account of the difficulty of thoroughly disinfecting them. For a tongue depressor a thin, narrow piece of pine wood is used, and burned after use, so that nothing is carried from one child's mouth to another's. This is a very important precaution, and has been the means of forestalling criticisms. The practice of having a child use his own finger for a tongue depressor is strongly condemned, in spite of its convenience, as the soiling of the fingers with the secretions of the mouth would greatly increase the danger of spreading the contagion. * * * *

Much has been done in giving advice to individual pupils on the subject of proper clothing, food, exercise and cleanliness. Inspectors are somtimes invited to address the teachers of their schools on such subjects, and sometimes mothers of younger children have been present to hear such addresses.

A great and salutary lesson in personal cleanliness, and one long remembered, was taught the children a few years ago when a systematic inspection was made of the heads of all the school children in Boston, for the purpose of discovering pediculi capitis. One-half of all the children were found to be infected, more or less, with these parasites, in some cases to a very disgraceful extent. In one of my primary schools, where the pupils were nearly all children of ignorant foreigners recently arrived from the "old country," nine-tenths of all the children were found to be infected. The need of proper treatment was so urgent that an exception was made in this one instance to the rule forbidding the giving of prescriptions, and each infected child was given printed directions to buy and properly use a good supply of crude petroleum. Those who were found on subsequent examination to have neglected this advice were promptly excluded from school until they returned clean. * * * *

Shower-baths have been put into the basements of some of the recently constructed school buildings, and children are now allowed and

sometimes requested to make a systematic use of them during school hours.

In his last annual report, Dr. S. H. Durgin, Chairman of the Board of Health of the city of Boston, shows the results of school inspection in that city as follows:

List of Diseases Found in the Schools.

SUMMARY.

Specific infectious diseases	505
Oral and respiratory diseases	2,609
Diseases of the ear	87
Diseases of the eye	431
Diseases of the skin	3,421
Miscellaneous diseases	3,568
Found free from disease	4,952
	15,573

Number of pupils examined in the schools	15,573
Number recommended to be sent home	3,055
Number consultations with teachers (about pupils returning to school, etc.)	3,440

I.—SPECIFIC INFECTIOUS DISEASES.

Diphtheria	23
Scarlet fever	23
Measles	121
Whooping-cough	62
Mumps	107
Chicken-pox	108
Influenza	50
Erysipelas	2
Syphilis	3
Tuberculosis	2
Malaria	4
	505

II.—DISEASES OF THE ORAL AND RESPIRATORY TRACT.

1. Mouth.

Stomatitis:	
(*a*) Simple (erythematous)	7
(*b*) Aphthous (herpetic)	1
(*c*) Ulcerative	1
Alveolar abscess	31

2. Pharynx.

Acute pharyngitis	438
Hypertrophic pharyngitis (acute and chronic)	88

3. Tonsils.

Acute follicular tonsillitis	1,281
Hypertrophic tonsillitis	407
Abscess	2

4. Uvula.

Elongation	12

5. Nose.

Acute rhinitis	47
Chronic rhinitis	5
Purulent rhinitis	2
Ozaena	7
Deviations of septum	1
Epistaxis	17

6. Naso-Pharynx.

Naso-pharyngitis (Post-nasal catarrh)	33
Adenoid disease	58

7. Larynx.

Acute laryngitis	51

8. Bronchi.

Acute bronchitis	119
Chronic bronchitis	1
	2,609

III.—DISEASES OF THE EAR.

Foreign bodies (cerumen, etc.)	1
Otitis media, catarrhal, acute.	12
Otitis media, catarrhal, chronic	12
Otitis media, suppurative, acute	6

Otitis media, suppurative, chronic	46
Imperfect hearing (without visible cause)	10
	87

IV.—Diseases of the Eye.

Foreign bodies	13

2. Eyelids.

Blepharitis	23
Stye	14
Ptosis	3

3. Lachrymal Organs.

Obstruction of duct	4

4. Conjunctiva.

Conjunctivitis:	
(*a*) Acute catarrhal	88
(*b*) Purulent	2
(*c*) Phlyctenular	10
(*d*) Granular	13

5. Cornea.

Interstitial keratitis	3
Ulcer	13
Opacity	7

6. Iris.

Iritis	3

7. Muscles.

Strabismus	12
Nystagmus	3
Imperfect sight (without visible cause)	220
	431

V.—Diseases of the Skin.

Acne	17
Alopecia areata	12
Dermatitis	86
Eczema	337
Erythema simplex	18
Furunculus	13
Herpes simplex	68
Herpes zoster	8
Impetigo contagiosa	227
Pediculosis	2,316
Pemphigus	8
Pityriasis maculata et circinata	3
Psoriasis	6
Purpura	2
Scabies	42
Seborrhœa	24
Tinea favosa	10
Tinea tricophytina	162
Urticaria	61
Verruca	1
	3,421

VI.—Miscellaneous Diseases.

Anæmia	94
Debility	90
Headache (habitual)	206
Cervical adenitis	136
Chorea	14
Ulcer	42
Deformities, spinal extremities	7
Sprains	34
Fractures	3
Contusions	40
Wounds	66
Abscess	39
Dental caries (painful)	23
Neuralgia	34
Epilepsy	6
Rheumatism	27
Cardiac diseases	20
Gastric diseases	215
Intestinal diseases	14
Urinary diseases	29
Vaccinations (performed)	501
Certificates of vaccination	1,855
No disease	4,952
Unclassified	46
	8,520

Cambridge. From the annual report of the school committee of the city of Cambridge, for the year 1900, the following is extracted:

"In 1894 the Board of Health, in accordance with the request of the school committee, appointed a physician, whose duty it is to examine all contagious diseases reported, and to direct the exclusion from the schools of all pupils whose presence will, in his opinion, be a menace to the health of others. He reports his action on every case to the secretary of the school committee. The physician issues all certificates authorizing such children to return to school, as authorized by Chapter 496, Section II., Acts of 1898.

"As a further precaution against contagious diseases, the Board of Health established, February 26, 1896, a system of medical inspection of children in the schools. The city was divided into six districts, in each of which a physician was appointed to visit the schools in that district. The duties of these physicians as now defined are as follows: To visit the schools subject to their inspection during the morning session of every school day; to examine such children as are indicated to them by the teacher as having complained, or as appearing to be suffering from disease; to inspect such other children or such parts of the building as they deem necessary for the protection of the pupils, examining at least one school each day; to recommend to the principal to send home immediately any pupil whom they may suspect of having any infectious or contagious disease, and also in cases of nearsightedness or deafness of pupils, to advise the parents to have the eyes or ears of such pupils examined. On the first of each month the physicians send a report of their work to the Board of Health.

Brookline. The following extract from a letter by H. Lincoln Chase, published in the Brookline Chronicle, May 25, 1901, shows the action which has been taken in that city:

"The agent of the Board of Health was authorized to arrange for and supervise the inspections, and the morning after the vote of the board, the six medical inspectors had been selected and assigned to their respective schools, then fifteen in number. The school department cooperated with the Board of Health in this measure and continues to do so most cordially, the truant officer being of great assistance. Excepting the Newton street school, which is not in a densely populated district, and has but twelve or fourteen pupils, all the public schools of the town are systematically inspected, daily, or less frequently, according to the requirements of the situation. During some periods since 1894 the inspection has been wholly suspended, because the freedom of the town from contagious diseases has seemed to warrant it. Soon after the parochial school was opened, the Board of Health offered it the same medical inspections that the public schools have, and the offer was accepted. At the beginning the agent of the board called a meeting of the medical inspectors and the substitutes, and explained the system in use in Boston. The inspection is made a little after 9 A. M., that being the time suggested by the superintendent of schools, and each room is visited. The teacher in charge of the room reports any pupil who seems to be in any way ill, and in addition to this the doctor makes a general survey of all the children in each room. If any child seems to be ailing, the inspector advises the teacher as to whether the child should be allowed to remain in school or not, and in the latter event, sends a note to the child's parents on a blank provided for the purpose, stating that the child is ill, and whether in his opinion the family physician should be sent for.

Malden. In his annual report for the year 1900, Mr. George E. Gray, superintendent of schools, writes as follows:

The work of the medical inspector occupies seven and one-half hours of his time for every week of the school year. It is his custom to visit the schools in rotation and to examine in the offices of the principals such pupils as are sent to him by the several teachers. When he began

his labors two years ago, it seemed to be necessary that he should devote his time at first to the eyesight and hearing of school children, and it was believed when this work was completed that he would be able to give time to other school matters requiring his professional services. Strange as it may seem, the work of examining eyes and ears still occupies practically all of his time, and the end is not yet. When this end is reached, there still remains a large amount of work similar to that done by medical inspectors in other cities, of great interest and importance. It was hoped that the appointment of a medical inspector would have some influence in discovering contagious diseases, cases of malnutrition, etc., and be of service to the teachers in the matter of heating and ventilation. Under present conditions these matters must wait.

Marlborough. Mr. J. A. Pitman, superintendent of schools, says in his latest annual report that medical inspection of the public schools is contemplated, and in a letter dated June 11, 1901, he states that the recommendation has been approved by the school committee, and that the work will proceed.

New Bedford. William E. Hatch, superintendent of schools, writes as follows: "We have about 7500 pupils in daily attendance in our schools, and we have two medical inspectors. We have no regulations or ordinances which apply specially to their work. They are under the general direction of the Board of Health and superintendent of schools, working in coöperation. We have a monthly report from each inspector, but these, of course, have not been tabulated in such form that they can be sent out, nor have I any data from which I can figure the absolute effect of medical inspection. We find medical inspection helpful in reducing contagious diseases in schools, and also helpful in furnishing us aid in securing attention to defective eyesight and hearing as well as in matters of cleanliness."

Newton. Superintendent Alfred B. Fifield says: "I would say we do not have daily medical inspection in our schools, although our school board is in favor of it, and we have now before the city government a request for an appropriation sufficient to establish daily inspection. This matter was referred by the Board of Aldermen to its committee on finance, and I have learned that the committee will report that it is inexpedient at present on account of the very large sums of money required for school expenses. I am pretty sure that the city government, including the mayor, see the wisdom and desirability of medical inspection, and that we shall before another year in all probability secure an appropriation for the purpose. At present our schools are inspected only three times a year by two agents of the Board of Health. These inspections are made at the beginning of each term, but are, of course, entirely insufficient to afford real protection from contagious diseases."

MEXICO.

City of Mexico. Dr. José Ramirez reports upon the medical inspection in the official primary schools of Mexico as follows:

"The Federal government has 473 primary schools in the Federal districts and two Territories, which are distributed as follows: 332 in the Federal district (146 in the Capital and 186 in the Prefectures), 45 in the Territory of Lower California and 96 in the Territory of Tepic.

"Article 80, of the Law of Obligatory Education, dated 3rd of June, 1896, provides that there shall be inspecting physicians for these schools. At present there are six appointed, distributed as follows: Two for the Capital, two for the Prefectures, one for Lower California and one for Tepic.

"The regulations of the general primary education office specifies their obligations in Articles 24, 25, 26 and 27, which we may summarize as follows:

"I. They must visit at least three schools every day.

"II. They will examine the pupils with regard to the state of their health, their cleanliness and whether or not they are vaccinated. Should they not be vaccinated, this will be done, and they will even be re-vaccinated if they are working.

"III. They will examine the hygienic conditions of the school house, both in a general way, and especially in connection with its purposes, looking to the space, light and ventilation.

"IV. They will examine the furniture and school fittings from a hygienic point of view.

"V. They will examine the age of the pupils in connection with the group to which they belong and inspect the physical exercises from a hygienic point of view.

"VI. They will at once report to the Supreme Board of Health and to the General Education department whenever they find some hygienic deficiencies which might be injurious to public health.

"VII. They will fulfill the commissions connected with their office with which they may be charged by the director general.

"VIII. They will present weekly written reports showing the results of their visits and commissions.

"Besides the above, anthropological studies have been undertaken of a general character, and particularly of the organs of vision of the pupils, who form a total of 60,000, more or less.

MICHIGAN.

Grand Rapids. Superintendent W. H. Elson states that medical inspection has not been begun, but free treatment of defects in the teeth of pupils has been provided by the voluntary service of dentists of the city.

Saginaw. Superintendent E. C. Warriner writes: "No medical inspectors have as yet been appointed in Saginaw, although I am heartily in favor of the idea. Our teachers make an examination of the sight and hearing of all pupils under their charge each year, keep a record of the same and also notify parents where defects are found to exist.

MINNESOTA.

Minneapolis. Dr. R. O. Beard writes as follows: "Your letter to Dr. C. M. Jordan, superintendent of the Minneapolis Public Schools, has been handed by him to me for attention, since I have been engaged as the head of the medical inspection force of this city. The system was inaugurated some three months ago and can hardly be said to have reached a good working order as yet. The board of education has appointed a force of fifty-five inspectors who do volunteer service. An inspector is assigned to each school and the schools are divided accord-

ing to our high school districts. Each high school district is in charge of a chief medical inspector, to whom the daily inspectors make weekly reports, which are summarized and sent in monthly by the chief inspector to the board of education.

NEW JERSEY.

Section 255, of chapter 96, of the laws of 1900, provides that "every Board of Education may employ a competent physician to be known as the medical inspector, fix his salary and define his duties. Said medical inspector shall visit the schools in the district in which he shall be employed at stated times, to be determined by the Board of Education, and during such visits shall examine every pupil referred to him by a teacher. He shall at least once during each school year examine every pupil to learn whether any physical defect exists, and keep a record from year to year of the growth and development of such pupil, which record shall be the property of the Board of Education, and shall be delivered by said medical inspector to his successor in office. Said inspector shall lecture before the teachers at such times as may be designated by the Board of Education, instructing them concerning the methods employed to detect the first signs of communicable disease and the recognized measures for the promotion of health and prevention of disease. The Board of Education may appoint more than one medical inspector."

Section 122 of the act above referred to gives to Boards of Education authority to protect the schools against the attendance of infected pupils or teachers, and Section 22 of chapter 68 of the laws of 1887 provides 'that any Board of Education, school trustees or other body having control of the public schools may, on account of the prevalence of any contagious disease, or to prevent the spread of such contagious disease, prohibit the attendance of any teacher or scholar upon any school under their control, and may specify the time during which such teacher or scholar shall remain away from such school, and may prohibit the attendance of any unvaccinated child who has not had the smallpox, and shall also have the power to decide how far re-vaccination shall be required if a case or cases of smallpox have occurred in the city or district."

Section 23 of the same act makes provision for the free vaccination of school children, as follows: "That at the enrollment of the children by the clerks of the school districts in the townships of this state, or by other proper officers in the cities or municipalities, inquiry shall be made as to how many of the children within the school age are unvaccinated, and the same shall be designated by a mark on the said roll, and in case any are found to be unvaccinated, whose parents desire them to be protected from smallpox, and who, in the judgment of the Board of Education or the trustees of the school districts, are unable to pay therefor, the clerk of said district, or other authorized person, may give to the said child or children a permit to appear at the office of any regularly-licensed physician in said district or municipality to be vaccinated, and such physician, on presentation of said permit, with his certificate appended thereto that the said vaccination has been by him successfully performed, shall be entitled to receive from the said township or local municipal authority the sum of fifty cents for each

case so certified, and the same shall be paid in the same manner that other bills or current expenses are paid therein."

Asbury Park. Medical inspection of pupils in the public schools was first regularly instituted in Asbury Park in the fall of 1900, but volunteer service had been performed to some extent during the previous year. Dr. John Taylor was appointed medical inspector, and for his convenience in conducting the work he was provided with an office in the High school building, and the following articles were purchased: A cabinet for record cards, adjustable gas lamp and mirrors for examing ears, noses and throats, nasal and ear specula, stethoscope, scales, measuring rod, tape measure, test types, test worsteds, wooden tongue depressors, set of tuning forks, glass dishes and towels. The duties imposed upon the medical inspector by the Board of Education consisted of two wholly distinct lines of work; first, the detection of communicable diseases among the pupils, and, second, the examination of pupils for the purpose of recording from year to year the degree of physical development attained in the case of each pupil.

The following blank cards are used by the medical inspector in making his records, each card measuring four inches by six inches, and being permanently filed in the card-cabinet before mentioned:

No._____ Date_____ Class_____

Name_____ Age_____

Weight_____ Height_____ General condition_____

Chest measurement_____ Inspiration_____ Expiration_____

Dorsal spine _____

Cutaneous diseases _____

Heart_____ Lungs_____

Throat _____

Naso-pharynx_____

Nasal Septum_____ Teeth_____

Eyes { R._____ Color } _____
{ L._____ Sense } _____

Ears { R. _____
{ L. _____

Date of last successful vaccination _____

A supply of these cards is placed in the hands of each teacher, and pupils are sent to the inspector from time to time as the following table shows. The inspector visits his office in the school building at ten o'clock every morning as nearly as possible, and, by messenger, summons any children for whom cards have been delivered at his desk, and these cases are then disposed of (1) by returning pupils to the

class rooms when the illness is of a trivial nature; (2) by sending the child to its home with a notice drawing attention to the need of medical care, as in urticaria, etc., and (3) by excluding the child when the illness is found to be communicable. It should be noted that before any child is excluded from the schools the facts relating to the case are first reported to the superintendent, and no action is taken until his approval is given. Following is the form of the card used in notifying parents in cases of communicable diseases:

Asbury Park Public Schools—Medical Inspection Department.

.....19...

Mr.....

Dear Sir: Symptoms of illness have appeared in the case of ...., and you are advised to place the child under the care of your family physician. When the child returns to school a physician's certificate, showing that recovery has occurred, should be furnished.

Very respctfully,

..... M. D., Medical Inspector.

The annual examinations for learning the growth and development of pupils are conducted in the afternoon from time to time, as the convenience of the medical inspector permits, and it has been found that when an assistant is present to write the record, five children can be examined in one hour. Following is the form of the blank card used for recording these operations:

The medical inspector will visit the school buildings each day at ten A. M.

Date_____

Name of pupil_____

Residence _____

Age_____ Class_____

Any cases of sickness at home?_____

Symptoms noted by teacher: _____

_____

Teacher.

This card is to be filled out by the teacher when any pupil appears to be ill. This card should then be sent to the doctor's desk.

Camden. Henry H. Davis, M. D., states that medical inspection of schools in the city of Camden has been regularly established. The population of the city was, by the last census, 75,935, and the enrollment of pupils in the public schools numbers 13,000 (ap.). There are 29 schools and 317 divisions. Dr. Davis has been appointed to the office of medical inspector, and he visits each of the schools at least as often as once in each month. Upon notice from any teacher, Dr. Davis immediately visits the school and takes such action as may be necessary for the prevention of the spread of disease, including the exclusion of infected pupils, cleansing of the infected portions of the school building and subsequent daily inspection of pupils who have been exposed to infection.

Jersey City. From Henry Snyder, superintendent of public schools, it is learned that by arrangement with the city Board of Health the city physicians, eight in number, act as medical inspectors in the schools. These officers visit the schools twice a week, inspect each building and its surroundings and examine the children to discover evidence of contagious disease. Should they detect a case of contagious disease they direct the principal at once to exclude the child from school.

Mount Holly. Dr. R. H. Parsons, president of the Board of Health, writes that the Board of Education of Mt. Holly has appointed a medical inspector for the public schools, who visits the schools regularly and examine the children who show any signs of illness. He makes such disposition of each case as the circumstances warrant. One address has been given to the teachers on the early symptoms of communicable diseases. Vaccination has been required as a prerequisite to admission to the schools.

Newark. Dr. A. B. Poland, city superintendent of schools, writes: The question of medical inspection is now before our Board of Education and it is likely that medical inspectors will be appointed before the opening of the fall term. The number of medical inspectors and their compensation has not yet been determined.

Orange. W. M. S. Wingle, superintendent of public schools, says that medical inspection has not yet been adopted, but it has been recommended.

Passaic. Superintendent F. E. Spaulding writes: I have recently brought this subject to the attention of my board, with the recommendation that medical inspectors be employed. The committee to which the matter was referred will, I think, report favorably.

Paterson. Four medical inspectors of schools have been appointed, and the following instruction for their guidance have been issued:

"Inspectors are required to visit all the schools to which they have been assigned between the hours of 9 A. M. and 11 A. M. every day that school is in session, and, as far as practicable, at the same hour each day.

"They are to carefully examine each child that has been isolated by the principal or teacher in charge, and cause to be excluded from school each one affected with or showing symptoms of any contagious

or infectious disease, more especially the following: Measles, diphtheria, scarlet fever, croup, whooping cough, mumps, contagious eye diseases, parasitic disease of the head or body, or chickenpox. They shall furnish each pupil that is to be excluded with a printed card, upon which they shall note the date, name and location of the school, name, age and address of the child, and reason for its exclusion. These cards, signed by the medical inspector of the school, are to be taken home by the excluded pupils. Each day, before leaving a school, each inspector is required to fill out a printed daily report blank, giving the date and time of visit, the name, location, district, the number of children examined, (male, female and total), the full name, age and address of each one excluded, with the diagnosis of each excluded case. On the last school day of each week, the printed summary blank, on the back of the daily report blank used that day, is to be properly filled out for each school day that week, and a duplicate filed with the secretary of the Board of Education. Each day, as soon as possible, after leaving the last school to be visited, inspectors are required to mail a separate daily report (properly folded and backed) for each school visited, to the office of the Board of Health, where a daily summary is made of the work performed in all of the schools visited.

"Children excluded on account of whooping cough, mumps, contagious eye disease, parasitic disease, etc., should be told to return when cured, and should be again examined before returning to their class room; if not entirely well they should be again excluded.

"The inspector shall ascertain from the principals and teachers of the schools the names and addresses of all children having contagious diseases in their families where notification has not been sent to the schools by the Board of Health, and such lists shall be forwarded with the daily report. Inspectors shall keep a daily record in a blank book, furnished for such purpose, of the number of children examined, (male or female and total), the full names, ages, residences and cause for expulsion of those excluded from school.

"If, by reason of illness or other cause, an inspector is unable to report at a school, arrangements must be made, by him, with an inspector of another school to act as a substitute, and the health officer informed of the fact without unnecessary delay.

"If, in the opinion of an inspector, immediate action should be taken by the Board of Health in any case, he should immediately communicate by telephone with the office of the Board of Health.

"Inspectors shall report at the office of the Board of Health once during each month, the time to be designated by the health officer. Exclusion cards for pupils, daily report blanks, addressed envelopes, blank books for recording the work performed, wooden tongue depressors, will be furnished at the office of the Board of Health.

"The daily duties of the inspectors shall cease when they have mailed their reports, after leaving their schools. They are not under any circumstances to visit children in their homes, to prescribe for them or suggest treatment at the schools. The treatment must be received from the family physician, in the dispensaries, or in the hospitals.

"Said medical inspectors shall, when so required, meet and instruct the teachers of their district in matters relating to the discovery of communicable diseases and their proper isolation."

Plainfield. The annual report for 1898 of Mr. Henry M. Maxson, superintendent of public schools, contains the following record:

'In January the Board of Education appointed two school physicians, on a regular salary, to visit the schools systematically, and to inspect the buildings and the pupils, and who could be summoned by telephone by any principal that found a pupil in school that showed symptoms of disease. These physicians have examined all the pupils in the city in the matter of eyesight, hearing, vaccination and throat. This examination discovered over one hundred cases of defective eyesight and fifty or more cases of defective hearing, which were duly reported to the parents with recommendations to consult a specialist. In many cases the action has resulted in improvement, not only of the local defect, but of the general physical condition of the child.

Trenton. B. C. Gregory, supervising principal of public schools, says: "We have no medical inspectors in our schools, but I am about introducing the subject; indeed, shall bring it before the board within a month. I have discussed the subject in my annual reports for several years, and I hope we are on the line of action."

NEW YORK.[1]

Buffalo. Ernest Wende, M. D., health commissioner, says: "Your communication of the 16th ult., addressed to the superintendent of education, has been referred to this department. Replying thereto I beg to inform you that we have no regular medical inspector of schools, but, recognizing the necessity for such, we have detailed the quarantine hospital physician to make inspections of the public schools when he is not otherwise engaged. He manages to make semi-annual inspections and reports and, whenever indicated, such alterations are made as is necessary."

Elmira. C. F. Walker, superintendent of schools, reports that one physician is employed by the board of education of Elmira, and his duties are defined as follows: It shall be his duty to visit the schools and inspect whatever affects their sanitary condition; also to ascertain what pupils have not been vaccinated and exclude them from school, and at the next regular meeting to report to the board the names and residences of those so excluded. And he is empowered to exclude from the schools, as in his judgment it may be necessary, children attacked with or convalescing from contagious disease, or who reside in families in which contagious affections are known to exist, and to restore such pupils.

PENNSYLVANIA.

Lancaster. During an outbreak of diphtheria and scarlet fever the Board of Education appointed for temporary service two municipal inspectors to detect and exclude infected pupils. At the end of three months their work was discontinued.

Philadelphia. Medical inspection of pupils in the public schools was instituted in Philadelphia in December, 1899, by the acceptance, on the part of the Board of Education, of the voluntary service of 200 phy-

[1] Medical inspection of schools has, for several years, been in operation in New York City, but no facts have been received in response to inquires made by the committee.

sicians. Following are copies of circulars of instructions issued to the superintendents of schools and to the physicians who engage in the work:

To Dr.....

The Board of Public Education having arranged a system whereby the public schools of this city will receive competent voluntary medical inspection, you have, in pursuance of your application, been appointed visiting physician to the

..... School, ...
.....Ward.

The following instructions are given to guide you in the discharge of this service.

It is expected that you will visit the school daily between the hours of 9:30 and 10 A. M.

You will report to the principal of the school, who will inform you of any pupils needing your examination.

Such pupils will be brought to you by the principal; and wherever you find, by your diagnosis, that a pupil is in need of medical treatment for any complaint other than one appearing to be infectious or contagious in character, you will fill up, for such pupil, one of the "ordinary" diagnosis cards, with which you will be supplied, and will give it to the principal.

Wherever your examination leads you to believe that the pupil has, or is threatened with, any disease that is infectious or contagious in character, you will inform the principal that such pupil must be immediately sent to his or her home; and you will at once mail a "special" diagnosis card of the case to the secretary of the Board of Public Education, Room 295, City Hall, so that the Bureau of Health may be promptly notified.

You will understand that your professional services in all cases terminate with your examinations at the school, unless they should be further given at the request of the parents of pupils.

To.....

Principal of.....School,.....Section.

The Board of Public Education having arranged for voluntary medical inspection of the public schools by physicians recommended by the faculties of the medical colleges and the authorities of the various hospitals, the following directions are given you, and it is expected that you will obey them in all particulars.

You will instruct your assistants to report to you, each day, as promptly as possible after the different classes have taken their seats in the class-rooms, the names of any boys or girls who seem to need examination by the visiting physician; and, particularly, any who have coughs or throat trouble or any sign of an eruption on the hands or face. This report should be made to you not later than 9:30 A. M.

Dr. ....., ...,
has been designated as the visiting physician for your school.

He will report to you each morning, between the hours of 9:30 and 10:00 A. M., to ascertain whether his services are needed on that day.

If the names of any pupils have been reported to you by their grade teachers as needing medical examination, you will have these pupils sent to your private room, or some other place, where the doctor can examine them apart from the mass of children in the class-rooms. The better plan will be to have them examined pupil by pupil, and not in the presence of each other. If possible, you should be present at all these examinations; but your presence, or that of one of your assistants, is obligatory in all cases of the examination of girls.

Where, in the opinion of the visiting physician, any pupil requires medical treatment for complaints other than those appearing to be infectious or contagious in character, he will hand you a diagnosis card, signed by him, on which the name, residence, and age of the pupil, and the physician's diagnosis, will be written. You will then give the pupil a card, designated "card to be sent home with child," properly filled in its blank spaces, with instructions that it is to be given to the father, mother, or guardian of the child upon his or her return home.

If the visiting physician should inform you that any pupil has, or is threatened with, any disease that is infectious or contagious in character, you will immediately send such pupil to his or her home, first giving him or her one of the cards, designated "card to be sent home with child," properly filled in its blank spaces, and you will not permit such pupil to return to school without the proper certificate from a medical inspector of the Bureau of Health that he or she can safely do so.

You will keep on a blank form to be supplied for this purpose, a record of the diagnosis cards given to you by the visiting physician, and will forward this record, at the end of each month, to the secretary of the Board of Public Education, Room 295, City Hall.

SAMUEL B. HUEY,
THOMAS E. MERCHANT,
SIMON GRATZ,
Committee of the Board of Public Education.

The Philadelphia Medical Journal of November 24, 1900, says:

Partial reports of the work of the school visiting physicians of Philadelphia, presented at their recent meeting, were said to show that the voluntary service has been so efficient that it furnishes the best of arguments in favor of a paid service, as in other cities. Complete returns, beginning with the establishment of the service in January last, are being prepared, which will still further demonstrate the preventive measures taken in scores of cases by which the community has been benefited. It was determined to form a permanent organization, and a resolution was adopted requesting the Board of Education to grant the association the privilege of holding its meetings in a centrally located school building. Meanwhile a constitution is being framed by a committee. Communications were read from school medical inspectors in other cities relative to the work in such cities. In Chicago, it was stated, there are 50 inspectors who are paid $50 a month, and who daily visit the schools assigned them. It was claimed that fully 60 per cent. of the decrease of contagious diseases among school children since the establishment of the system in that city is due to the work of the medical inspectors. In New York, it was stated, there are 207 medical inspectors, who are each paid $30 a month. Each in-

spector has two schools, and the work has been found of the greatest benefit to the community. The system of medical inspection of school children in Boston was said to have been begun in 1894. The city is divided into 50 districts, and one physician to each is appointed by the Board of Health. The visiting physicians are not permitted to prescribe, excepting for poor families unable to pay for medical service. In the cases of contagious diseases the inspectors are required to visit the residence of patients, see if they are properly isolated, and report thereon to the Board of Health. In no case, however, must there be any interference with the attending family physician. The physicians are each paid $200 a year for their services. Like systems are about to be established in Washington and St. Louis. Philadelphia, it is said, is the only city having a voluntary corps of medical inspectors.

WISCONSIN.

Milwaukee. In his annual report for 1900, F. L. Schulz, M. D., commissioner of health, says:

The system of daily medical inspection of schools, as recently introduced in this city, must commend itself to every thoughtful and loyal citizen. It has long been recognized that schools are an important factor in the spread and propagation of the acute infectious diseases. The close communication for five or six hours daily of a large number of children peculiarly susceptible to these diseases, in rooms generally over-crowded, and in many instances lacking in proper light and ventilation. The habit among children of exchanging toys, slates, pencils, etc., the common use of a single drinking cup, are all favorable factors in disseminating contagious diseases.

In my annual report for 1898 I called attention to this fact and recommended a system of daily inspection of our public schools. It was not, however, until the beginning of this year (Jan. 1900) that a perfect system of daily medical inspection was introduced.

After consultation with the superintendent of schools and members of the School Board, the following circular letter was forwarded to all the school principals in the city:

Commencing Tuesday, Jan. 23, 1900, the Health Department will establish a system of daily inspection of all public schools in the city of Milwaukee, by a corps of competent medical officers, appointed expressly for this office.

By adopting this method of medical supervision of our schools the Health Department expects to overcome, in a great measure, the present prevalence of many communicable diseases incidental to school life.

The success of this plan depends largely upon the coöperation of the school principals and teachers in the work, and upon the strict observance of the following regulations:

1. Hours of inspection from 9 to 10:30 A. M. daily.

2. A convenient room should be selected in each school to be designated "Quarantine Room," and to be used for this purpose only.

3. All scholars who have been absent from school on account of sickness for two days or more, shall, upon their return, be sent to the quarantine room awaiting the arrival of the medical officer.

4. All children who have recovered from, or in whose family there have existed the following named diseases: Diphtheria, membranous

croup, scarlet fever, measles, whooping cough, and who have received from this department a certificate of health, shall, upon arrival at their respective schools, be detained in the quarantine room until their condition has been passed upon by the medical inspector.

5. Whenever a child arrives in school ill, or is suffering from any disease which the teacher has reason to suspect of being contagious in nature, such child shall be immediately sent to the quarantine room to await the arrival of the doctor.

UTAH.

Salt Lake City. E. T. Whitney, M. D., medical inspector of schools, writes as follows:

I was appointed medical inspector of schools December 5th, 1900, and am the first and only one in this city. An epidemic of smallpox was upon us at that time.

Principals report at once, by messenger, to the superintendent's office, any cases of suspicious illness occurring in the schools. If the principal fears very strongly a contagious disease, he sends the child home, where I see it, otherwise I make the inspection at the school.

Children who are kept at home for illness four days, but have not had a physician, I see to discover mild cases of contagious disease.

Pupils out four days, the cause being unknown, are seen by me to discover concealed cases. A case of scarlet fever was discovered by me in a Christian Science family and the father was fined $25 in a police court for failure to report the case.

I distributed Snellen's test types to the schools (25 in number), and demonstrated their use to the principals. I also delivered twenty-five lectures, an hour long, on teeth and their care.

Many of the replies received from localities where no steps have yet been taken to establish medical inspection of schools indicate nevertheless that active interest is taken in the subject, and in numerous instances assurances have been given that efforts will be made to put the system in operation at an early day. A careful analysis of the correspondence shows that there is widespread interest in the work which has been already done, and it seems to be a safe prediction that in the course of one or two years a considerable number of the more progressive communities throughout the country will have adopted some method for the early detection of disease among children who attend the public schools. The considerations which have influenced public opinion on the subject and the arguments brought forward to sustain the views advanced in its favor may be briefly stated as follows: The State, by statute, requires school attendance at an age when the individual is peculiarly prone to fall a victim to the diseases which prevail in all groups of young persons, and in assuming the control and custody of the child during five hours each day the State becomes morally responsible for the protection of the health of the pupil during that period, and it is wholly indefensible that public schools shall be conducted in buildings which are insufficiently ventilated, lighted and

warmed. It is equally indefensible to bring children together, by lawful authority, without using every reasonable endeavor to weed out and exclude infectious individuals. The justification which warrants the State in the enforcement of the requirement compelling all children to obtain an education is purely economic in its principles, and on the same basis it is quite as reasonable for the State to require that all citizens shall avoid premature death, and in fact this logical claim to the benefits which attend the normal duration of the life of the individual has long been demanded by civilized governments the world over. Thus the laws of many countries make suicide a crime, and on this ground laws are made to secure hygienic conditions on private premises. The value of the citizen to the commonwealth, and the gain if he shall live out his natural expectation, is understood and admitted by all statesmen. How thoughtless then has been our course heretofore in admitting to intimate association the sick and the well in one unrestricted group in our public schools! And it is high time that measures should be instituted to stop the needless slaughter. Every observing man knows that the astonishing diminution in the mortality of infants which has occurred during the past ten years has been almost solely due to a better understanding on the part of mothers and nurses of the value of pasteurization of milk, and medical inspection of schools promises to accomplish results almost as valuable in preventing the spread of diphtheria and scarlet fever as the proper care of milk has rendered in eradicating infantile diarrhœa.

It has been observed, first, by a distinguished English sanitarian, that communicable diseases prevail to a less degree during vacation periods than during the school year, and this significant fact supports the view previously advocated concerning the advantages which will attend daily inspection of all school pupils suspected by the teacher to be ill.

Parents frequently fail to detect illness, and the teacher who is experienced can be relied upon to note the early symptoms of the onset of the dangerous affections with far more skill than the average parent, and by cultivation of this power of observation on the part of the teacher, and by prompt and judicious disposition of the cases reported to him by the medical inspector a service of immense financial value to the State can be rendered. When we add to the benefits already referred to, the relief from suffering to both child and parent which will be effected by diminishing the number of individuals to be attacked by the communicable diseases, who will vote against the adoption of this measure for improving the public school administration?

Because of its being an untried innovation the voluntary service of physicians has been asked for by school boards in several cities, but the

experimental period has now been passed, and it is no more unreasonable to expect teachers and janitors to perform the duties pertaining to their respective departments without compensation than to expect the medical inspector to provide professional service without remuneration. In carrying into effect the purpose of his appointment it is very desirable that the line to be drawn between the duties of the medical inspector of schools and those of the local board of health shall be sharp and well defined. The medical inspector should devote himself solely in his official relation (1) to the medical questions relating to the detection of the presence, among the pupils, teachers and janitors, of cases of communicable diseases; (2) to observations concerning the growth and development of each child; (3) to observations and records relating to defects in the vision and hearing of the pupils; and (4) to the avoidance of hysteria, chorea and various other school-made diseases.

Medical inspectors should not assume responsibilities relating to the sanitary condition of school buildings, nor is it a part of their duty to direct or conduct the disinfection and purification of infected apartments. All of these matters should receive attention from the local health board, and complications of an unpleasant nature are liable to arise if the medical inspector intrudes into a department over which he has no control. The medical inspector of schools will be doing all that is necessary or that can reasonably be expected in this particular, if he calls attention in his weekly, monthly or annual reports to the defects which he may observe in the condition of the school buildings, the water supply, the lighting and heating, or to overcrowding and other errors of management which may affect the health of pupils unfavorably.

To prevent misunderstandings, it is very desirable that rules for the guidance of the medical inspector of the schools should be prescribed by each board of education, for in the absence of such rules the work of the school is liable to endless interruption.

Rules for this purpose might embrace the following suggestions:

1. The medical inspector shall visit the school buildings within his district as nearly as possible at the hour of 10 A. M. each school day.

2. Every teacher shall, before 10 A. M. each day, send to the desk of the medical inspector a statement in writing, on blank cards provided for this purpose, showing name of every pupil who appears to be ill or who is suspected to be infected with any communicable disease. Every such pupil shall be isolated at the discretion of the teacher until the arrival of the medical inspector.

3. Upon his arrival at the school building the medical inspector shall proceed to inspect the pupils referred to him by the teachers, and if any pupil is found to be, in his judgment, too ill to remain in school, or if

any pupil is believed by the medical inspector to be affected with any one of the communicable diseases, the medical inspector shall deliver to every such pupil a notice in writing addressed to the parent or guardian, written on a blank form provided by this board, advising that the child shall be placed in the care of the family physician, and also excluding the child from school until recovery has occurred. No such pupil shall be again admitted to school until he shall bring a certificate from his attending physician showing that he is no longer ill, or shall be adjudged by the medical inspector to be free from infection.

4. The medical inspector shall preserve, in a suitable file, all written statements received from teachers, and he shall also make and preserve duplicates of all notifications sent to parents or guardians.

5. The medical inspector shall, at his convenience, once in each year, determine the weight, height, strength and proportions of each pupil, and keep records of all such facts.

6. The medical inspector shall vaccinate all pupils and teachers who may make application for this service. He shall be reimbursed by the board of education for the cost of vaccine used in said vaccinations. He shall keep a record showing the vaccinal status of every pupil, teacher and janitor. No pupil shall be admitted to the schools of the district unless satisfactory evidence is produced to show that said pupil has been successfully vaccinated, nor unless re-vaccination has been performed within five years.

Closing Public Schools. The closing of public schools for preventing the spread of contagious diseases is very rarely necessary, and the objections to this measure are so serious that its employment should be reserved for conditions which cannot be met in any other manner. To close the schools because three or four or more cases of scarlet fever or diphtheria occur among the pupils is too often the only effort made to restrict the spread of the disease, and this action may generally be regarded as evidence showing that the health officer or school officer who is responsible for the closing of the school thereby admits his inefficiency and incompetency.

It should be a source of humiliation to any capable sanitary officer or school officer to find himself so insufficiently supported by his official associates that he is unable to apply to the school building under his control the recognized methods of purification and cleansing during outbreaks of the dangerous communicable diseases, and thus render the building and everything within it free from infection and entirely safe for the admission of all uninfected pupils. Daily inspection of the pupils by a competent medical officer, and the instant exclusion of pupils, teachers and janitors found to be infected, will permit and fully warrant uninterrupted continuance of the school work.

NOTES ON THE NECESSITY OF ATTENDING TO THE HYGIENE OF THE MOUTH AMONGST THE PUPILS OF SCHOOLS.

By Dr. JUAN BREÑA, Zacatecas, Mexico.

La Médicine guérit les individus l'hygiène sauve les masses.
Michel Lévy.

Diseases of the teeth and mouth have very recently been the object of special attention. In this short paper my aim is to lay stress on the necessity of protecting young people during the period of their studies against the spread of such kinds of complaints as well as of curing them when once contracted. Much has been said regarding the causes which predispose to and bring on more or less destructive classes of inflammation of the gums, the tongue, the palate, the pharynx, etc., and, in particular, the etiology of dental caries, which was supposed to have been a settled question, has been the subject of discussion in England last year.[1] But, whether we accept as true the theory of Galipe, or the contrary one of Black and Williams,[2] whether we recognize as a principal factor the culinary refinement of modern life, the use of bread deprived of earthy matter, made of flour ground in roller mills to the exclusion of the old stone ones, respiration by the mouth and consequent desiccation of the teeth, nasal obstructions, the chemical action of water and food, particularly sugar, the temperature of the food and drink taken, or the poisoning due to foreign germs or to those appertaining to the "flora" of the mouth,[3] what is of importance, for the present, to note is that the disease-bearing influence is spreading with alarming generality, seeing that in countries and climates of disease characteristics scarcely any disorder can be pointed out which is more widely spread than molecular necrosis of the teeth. Though formerly it was admitted to be very common, no precise knowledge of the extent of its propagation was possessed until investigations made in England, Belgium, Germany, Sweden, etc., have demonstrated it with the inexorable exactness of numbers. In the annual report of the inspector of factories and workshops of England for the year 1900, Mr. Farnfield, the dentist to an industrial company,

1 The Lancet, Vol. II, pages 51, 134, 629, 770, 839.

2 Third International Congress.

3 As microbes peculiar to caries, some dentists (Frey) mention those of Galipe, Vignol, Miller: "B dentalis irridoms" of Goodby, "B neurodentalis," "B purvus," "B plexiformis," whilst others assert that there is no microbe peculiar to dental caries, and that it can be produced by any of the micro-organisms of the mouth (Choquet).

is reported to have said: "The greatest difficulty is at present in getting the requisite number of boys, as their teeth are mostly in a very bad state, and it is very difficult to persuade the average lad of fourteen years to trouble at all about them," and the inspector adds: "It will be recollected that the same difficulty occurs in the obtaining of suitable recruits for Her Majesty's army and navy," etc.

From the dental inspection of the public schools of the city of Antwerp last year the following facts were obtained:[1] The number of attendants of the schools in March was as follows: Boys, 9543; girls, 10,148; kindergarten, 4778; total, 24,469. The kindergarten are frequented by children of three to six years of age; in the other schools the ages vary between six and sixteen years. Amongst 12,000 children examined by Dr. Verhuysen, he found 1721 without caries, 2138 with one or two teeth affected, and 8141 with several teeth affected. During the first inspection 947 extractions were made, in the second 545, and in the third 405, making a total of 1897. In that same inspection cases were noticed of abscess of the antrum highmori, of facial phlebitis, of laxation of the maxilla, of necrosis exanthematosa, of noma, ránula sub-lingualis and of epulis. The statistics of children of from six to fourteen years of age and of youths of from twenty to twenty-three years of age which have been compiled in Germany by the recommendation of Röse are no less lamentable. The best localities had 78 per cent. of the people with diseased teeth and, in places where calcium is scarce, the percentage reached 99.[2]

In the inspection of English and Scotch schools, Cunningham found, amongst 10,517 pupils of the age of twelve years, 3527.9 diseased teeth and only 1508 of the children, or 14.2 per cent., had sound teeth. In Strasburg, according to Jessen, of 3000 children in the primary schools, only 165 had sound teeth, and the rest showed a total of 12,917 teeth more or less affected. The same authority adds that "the proportion is the same nearly everywhere."[3]

Besides caries of the teeth we must remember that several morbid affections such as "stomatitis suppurativa," "ulcerosa," "erythematosa," "gengivitis interstitialis," "pericementitis phagedénica," etc., are prevalent from time to time in epidemic form and, in the majority of instances, attack young people in preference to others. The same may be said of Rigg's disease, also called "saculosis," or "pyorrhea alveolaris," as also of hypertrophy or "granuloma" of the gums,

[1] Third International Dental Congress.

[2] E. Jessen (of Strasburg). Instruction of the public in regard to the value of dental treatment in relation to general health.

[3] E. Jessen (of Strasburg). Instruction of the public in regard to the value of dental treatment in relation to general health.

caused by "sacharomyceti," well known through the works of Rae, Gross, Murray, etc., and which, though uncommon, is sometimes met with.

Owing to the tendency which infancy, up to the age of puberty, has towards the development of diseases of the lymphoid and epithelial organs, the pharyngeal and post-nasal adenoid growths mentioned by W. Hunter, and also swelling of the tonsils peculiar to lymphatic temperaments, are affections which are almost general in educational establishments,[1] as has been shown not long ago in the professional examination made in the schools of the central district of London (1898). Bucco-pharyngeal tuberculosis is less frequent than caries, but more common than has been generally supposed.[2]

This error is explained by the attention which medical men devote preferentially to visceral manifestations of tubercular disease, leaving disregarded or unnoticed those which we are at present considering. The affection may be localized in the lips,[3] the gums,[4] the tongue,[5] the pharynx, the palate, the nasal cavity, the tonsils, the alveolo-dental border,[6] the inferior maxilla,[7] etc., and be caused by inoculation "in situ," or by general infection. The bacillus of Koch has a predilection for the buccal cavity, the folds and hollows of which where the teeth are placed are greatly in favor of its multiplication. It is, in fact, found in healthy subjects to such an extent that foundation for the parasitical theory of caries has been admitted. It is sufficient to consider, on the one hand, that, in certain circumstances, some of the affections referred to, in addition to the injury to health, represent obstacles to the intellectual advancement of young people, and on the other, that various means of instruction, such as reading aloud, declamation, recitals, singing, the frequent use of certain utensils and even ordinary conversations so frequent in school life are so many more opportunities for the transmission of the evil, to justify the importance of our subject in relation to the public health. In the present epoch that special manner of contracting diseases has been pointed out and made publicly known to such an extent that, in the discussion in the Odontological Society of Harvard on the longevity of dentists and the causes which tend to lessen it, mention was made, amongst other things, of the fact that in that profession "the breath of diseased people is inhaled, * * * fetid breaths are received

1 Report of Dr. Wilcock of the Charing Cross Hospital.
2 American Society of Laryngology. Philadelphia. 1896.
3 Societé de Dennatologie et Syphilographie de Paris, 1897.
4 Bernheim, Buccal and dental tuberculosis.
5 Irelat Reclus.
6 Bower Surgical Clinic.
7 Starck and Czerny.

and exhalations from diseased people who are not always scrupulously clean."[1]

It has been demonstrated that whatever the form may be of oral sepsis, it is susceptible of causing all the phlogoses, whether local or general, which are connected with pyogenic organisms, and, when tonsillar angina, adenitis, maxilla abscesses, alveolo-dental periostitis, suppurations of the middle ear, empyema, meningitis, ulcerous endocarditis,[2] osteomyelitis, etc., belong to this etiological group, they are characterized by symptoms of extreme gravity, which is accounted for by the great virulence proper to organisms of the necrobiotic cloak of the bones.[3]

In an article entitled "Dental Caries as a Factor of Disease" in the New York Medical Journal, we find the following: "Hundreds and thousands of people are going about with rotten teeth carrying with them so many small cesspools in their mouths, filled with fetid abominations of stinking food débris, with its teeming population of microorganisms and the resulting toxins as concomitants, and daily swallowing these putrefactions and absorbing the pus. Many cases of septic diseases are due to dental caries and to that alone." Other respectable publications have mentioned cases of infectious pyrexia which ended fatally and for which no other cause could be assigned than the affected state of the mouth. Hence the obligation of making a careful examination of that cavity whenever the infection of the blood can be traced clearly to no cause independent of oral sepsis. The limits of this article, too narrow for the subject treated of, do not allow me to mention in detail all the evils of the diseases of that part, the studying of which is divided, without any precise limitation, amongst dentists, rhinologists, aurists and laryngologists. I will, therefore, confine myself to mention merely some of the disadvantages which result from them to the education of the young. Thus, for example, a jaw deprived of certain teeth, causing a difficulty in the articulation of the sibilant dental sounds, prevents the acquisition and correct use of any language. Suppurations of the mouth produce putrid secretions which, mixed with the saliva, may be ejected in a disagreeable spray at the time of speaking, owing to the want of continuity of the dental arches. This makes the patient an object of repugnance and drives away from his person social relations to the notorious detriment of the development and cultivation of his intellect. The visual apparatus, the integrity of which is so essential for all kinds of study and which scholastic fatigues render particularly sen-

[1] W. E. Boardman (Boston). Longevity of Dentists, Dec. 7th, 1899.

[2] W. Ewart: A case of malignant endocarditis apparently due to dental caries, etc.; Lancet, 8th Aug., 1900, page 498.

[3] W. Hunter in British Medical Journal.

sitive to pathogenic influences, is not seldom subject to affections which, originated in the maxilla or the teeth, spread through the anatomical and physiological connections. The people who go about with decayed teeth are more numerous than those who smoke, and much more so than those who arrive at the stage of exhibiting symptoms of tobacco poisoning. In spite of this fact, almost all books on ophthalmology are careful to frequently point out amongst the causes of affections of the eyes the deleterious action of nicotine, and scarcely mention or entirely omit the disastrous influence which the irritation of the dental nerves may exercise on the sight. It has already been pointed out that, on this point as on others, specialists, even professors, devote themselves so strictly to the main object of their work that they deplorably neglect what concerns other branches of pathology, and forget the just appreciation of the relations which exist amongst affections of the different organs. However, remarks on this subject are not wanting. For instance, Wuker in 1866[1] treated of this matter, and, though very briefly, he touches upon it in his classic work.[2] Benneur[3] saw a patient die of septicemia with metastatical abscess of the orbit and thrombosis of the "sinus cavernosus" who, three weeks previously, had suffered the extraction of a molar tooth. Caries of these teeth, principally of the back ones, has caused empyema and sub-periostic abscess of the antrum Highmori"; thence the disease may pass to the orbit either through the veins or through the lymphatic vessels, or, in consequence of an osteo-periostitis of the base of the cavity of the orbit, which is very thin and apt to present apertures which allow the infection to pass. When this affection is acute, it attacks the brain and ends generally fatally, and, in cases in which the course of the disease is slow, "neuritis óptica retro-bullaris insidiosa," with "exophthalmos," strangulation, "chemosis," blindness and "pan-ophthalmia" are frequent occurrences.[4]

Vassins,[5] Pagenstecker,[6] Burnet,[7] mention suppurations of the orbit proceeding from caries of the teeth of the upper jaw. Samelsohn, Keyser, G. M. Lardier[8] speak of several diseases of the teeth as causes of "ambliopia" and "amaurosis." Galezowsky gives an account of a case in which the sight which had been destroyed completely for eleven months was regained by means of the extraction of a root in

1 "El Pabellon Médico," Madrid, Feb., 1866. Nos. 6 and 7, and "Annales d' Oculistique," Vol. LV., page 134.
2 Maladies desqeux, Vol. II, page 422.
3 Jahr f. Augenheilk, 1885, page 16.
4 Bull. Trans. Section on Ophthalmology, American Medical Association, 1899.
5 Archiv. f Ophthalmology, XXX. 3.
6 Jahr f. Augenheilk, 1884, p. 620.
7 Ibid., 1885, p. 16.
8 Rec. d' Ophthalmologie, 1875, p. 87.

which a piece of a wooden toothpick had become embedded.[1] Garretson gave an instance of mydriasis and pains in the eye cured by the extraction of an encysted canine tooth.[2] Hutchinson observed photophobia, extra-ocular spasms and neuralgia of the eye which disappeared by dental extractions.[3] The same system of treatment has cured ulcers of the cornea which had proved impossible to be cured by the ordinary methods.[4] A girl who suffered from epiphora in spite of the sound condition of her nasal and lachrymal passages was cured by the correction of certain defects in the position of her teeth.[5] Odontalgia is a frequent cause of imperfections in the accommodation either by spasms or by paralysis which, according to Max Knies, are attributable to want of vigor in the innervation caused by the pain.[6]

Out of ninety-two cases of neuralgia due to dental caries, Schmidt[7] found seventy-three of deficient accommodation. The same author, amongst other conclusions irrelevant to our object, says that "the considerable reduction of the accommodation, as a consequence of pathological irritation in the dental branches of the trigeminus, is usually an affection of young people." Paralysis of the motor muscles of the eye and even "amaurosis sine materia," such as oculists of the past understood it, have been observed as a consequence of the same etiological influence.[8]

Experience has shown that the hearing often suffers on account of dental irritations. The fifth pair of nerves in its superior and inferior maxillary branches is distributed in the teeth, and even the trifacial nerve in the otique and Meckel's ganglions communicates with others of the sensitive nerves and with the great sympathetic nerve, giving, besides, all the sensorial innovation to the hearing. It is, therefore, not surprising that any dental affection should make itself felt by reflex action in the organs of hearing. "From a somewhat extended clinical experience," says Bradford, "I have made it a rule to examine the teeth in every case applying to me for relief from otalgia, 'tinnitus aurium' or progressive impairment of the hearing. * * * In a large number of cases, especially in children, we find that the patient complains of a severe earache. An examination reveals the external auditory canal perfectly normal in color and presenting absolutely no evidence of any inflammatory process within the middle ear. In spite of this, the patient is suffering from otalgia, or pain referred to the

[1] Archiv. gen de Medicine, XXIII, pp. 261-264.
[2] System of Oral Surgery, p. 786.
[3] Royal London Hospital Reports, 1865.
[4] Sariguer Revista médica d' Sevilla, No. 6, 1899.
[5] E W. Stevens, Diseases of the Eye in Relation to Diseases of the Teeth.
[6] Relation of Diseases of the Eye to General Diseases, p. 267.
[7] Arch. f. Ophthalmologie XIV—1, p. 107.
[8] Stevens in the Dental Cosmo., Feb., 1901, p. 109.

ear. In numerous cases of this character examination of the mouth has revealed carious teeth. In adult patients usually one of the wisdom teeth is at fault, but in children the symptom is not infrequently a result of caries of the first molar."[1]

In adding to what has been already said that in almost all suppurative processes of the mouth, the uninterrupted deglutition of septic liquids permanently affects the health by means of a slow autoinfection, and that, in consequence of the correlation between the physical condition and the moral faculties, the patient finds himself exposed to the decay of his intellectual activity, his energy of character and his capacity for availing himself of the benefits of instruction, we have made a very brief synopsis of the dangers inherent in that class of complaints, which are, in every case, of the greatest moment, but especially disastrous in the organic development of the young.

Very efficient prophylactic measures have been decreed in some countries and they merit recommendation by the official delegates here present on account of their efficacy, along with such modifications as local conditions may call for in the opinion of the sanitary authorities. In countries where a republican and democratic rule prevails the forcible imposition of some of these measures is bound to meet with obstacles and resistance founded upon rights granted by the political institutions. The constant hostility between individual liberty and the limitations implied by laws to protect the public health will only disappear when the ignorance of the public be dissipated by the work and perseverance of assemblies such as the one I have the honor to address and people become convinced that, for the masses as for individuals, it is a question of life or death, of prosperity or decadence, to choose between the strict observance and the absolute disregard of hygienic principles. In a paper read before the American National Dental Association last year we find the following lines:[2] "Canada and many of the European countries have laws which prohibit admission to the public schools of children who have decay or disease in their mouths. With our republican form of government, however, we cannot secure such legislation until the public realizes the importance of the measure. And, indeed, were it a statutory requirement, the law could not be enforced without the sympathy and co-operation of the people. There has been, from time to time, a desultory distribution of tracts, pamphlets and papers containing information on the care of the teeth, but, having no influential authority to recommend them, they have made little impression on the laity.

1 Reflex Aural Symptoms Dependent upon Dental Caries. A paper read before the New York Odontological Society, Nov. 20th, 1900.

2 Percel Caley Popular Dental Education.

No organized effort to present the subject of oral hygiene to the people of the United States has ever been made. The difficulty of the undertaking is surpassed only by its possibilities for good."

We may reduce to three the practical forms for the propagation of the ideas, principles and doctrines relating to the hygiene of the mouth and teeth:

I. The first forms part of the duty of the doctor and must be put in practice among his private patients; it is clearly the one which will produce the most advantageous results. Every practitioner of intelligence will constantly meet with opportunities of popularizing the utility of attending to the cleanliness of the mouth in order to warn off disease, avoid deterioration and assure the completeness of the teeth. Simple descriptions, free from pedantic technicisms, of the dangers of oral sepsis, if given with prudence and on suitable occasions, will sink deep into the public mind. In laying stress on the great advantages of the preservation of the teeth, the necessity of closing the hollows produced by caries and of remedying as soon as it be discovered any defect whatever in the organs of mastication, attention will not fail to be called to an important symptom of many dental affections which is important on its own account as well as on account of the effects which it causes in the main functions of the system. I refer to the martyrdom of toothache, justly called in France "rage des dents," which, owing to the extreme sensitiveness of a child, makes it suffer to such an extent that it will refuse food for fear of the exacerbation of pain produced by mastication. Vitality thus suffers, and it is incontestable that there are few probabilities of long life when insufficient nourishment is taken. To impress upon parents that it is incumbent upon them to prevent and even to remedy such a state of things is the same as showing them that neglect in this delicate matter is not a slight omission, but one of the greatest moment, a piece of absolute cruelty, as are all the failures to comply with the sacred duties of humanity. I will say more. No one will deny or even cast a doubt on the fact that in many chronic affections, such as dyspepsia, chloro-anæmias, neurosis, etc., a temporary change of residence and leaving the heavy and nephitic atmosphere of the city for the pure air of the country or seaside will prove a powerful resource for organic and curative modifications. We must, however, impress upon our patients that all the expenses and inconveniences of traveling will prove fruitless and irrational when the patient carries with him a focus of infection at the entrance of the organs of respiration, and that if life is endangered by the emanations of defective sewage, it is still more exposed when by caries of the teeth or other suppurative affection there are harbored in the mouth, as in an incubator, various

pyogenic organisms and even the nosogen of diphtheria, of pneumonia, etc., which, inoffensive in a healthy man, may make all their violence felt whenever the least disorder exist in the system.

The really useful part of this teaching will come from the assurance which the doctor may conscientiously make of the preventive and curative power of the resources of modern dentistry and hygiene. With skillful treatment there is no affection of the mouth or teeth which may not be avoided, cured or considerably relieved. Even one of the most destructive and tenacious, "pyorrhea alveolaris," so often classed as a diathesic manifestation proceeding from rheumatism, syphilis or other constitutional derangement, disappears, without recurrence, by applications of pyrozone, sulphate of copper, nitrate of silver, trichloracetic acid, sulphuric acid, lactic acid,[1] chloretone,[2] etc., which are purely local remedies, the efficacy of which denotes the local character of the complaint, exemplifying the old adage, "Naturam morborum curationes ostendent."

II. In schools, colleges and other educational establishments the professors are those who ought to inculcate in the minds of the young people the importance to general health of the regular habit of maintaining the asepsis of the mouth and teeth. Periodical and obligatory lectures based on one of the many popular treatises on the subject in the United States, enlarged with explanations and commentaries vivâ voce, either on the necessity of washing and the use of the tooth-brush once or several times a day according to the tendency in such case towards the formation of tartar concretions, or on the quality of the articles of food which in a fluid or pasty state scarely, if at all, excite the activity of the organs of mastication, whilst articles of a certain degree of solidity excite the muscular movement which, in its turn, increases the circulation of the blood in the bones, the pulp of the teeth and the periosteum, causing a greater renovation of materials and a more abundant deposit of calcareous salts in the teeth, or finally on the injurious action of the products of fermented sugar which cause the abuse of substances containing it to be so dangerous, are excellent methods of instruction.

Just as there are daily inspections in schools as to propriety in dress, cleanliness of the hands and nails of each pupil and such like matters, it would be useful for the teacher to examine the mouth of each pupil and require him to consult a doctor whenever, in his opinion, there should be any defect requiring attention.

III. Finally, it is a matter of urgent need to have established in every institution dedicated to teaching a dental service to dispense

[1] Holz (of Paris) on pyorrhea alveolaris, 1900.

[2] J. S. McDonald, Zacatecas, Mexico. Chloretone in Pyorrhea Alveolaris.

means for the correction of anomalies in the position of the teeth, remedies for curing gengeväl and alveolo-dental complaints and to effect fillings and extractions rendered necessary by caries. I mean to say by this that a dental surgeon should be connected with each school in order to inspect all the scholars regularly. The immediate result of such examinations would be, firstly, the acquisition of statistics regarding caries at different ages, and, secondly, the knowledge of the total number of children who suffer from it, with information as to the number of teeth lost, those which can be saved, and the color, hygienic condition of the mouth, imperfections of size, number, structure, collocation and time of cutting, all of these being most essential data for determining if the mastication be defective.

When we see that governments provide their armies with people capable of scientifically attending to the preservation of the soldiers' teeth, we cannot understand the disregard of the necessity of imparting the same kind of protection to the young people who attend the schools.[1] This question is at present under discussion in Belgium, Sweden, Germany, some parts of France, etc., and the only novelty in our suggestion consists in the advice that this point regarding the public health should be attended to in our respective countries with all the care demanded by our culture.

Professional intervention in schools should have the rank of official functions and be conducted strictly by qualified dentists. We are aware that somewhere it has been said that the presence of a dentist is unnecessary in establishments visited by a medical man, the reason given being that diseases of the mouth are included in the pathology embraced "in extenso" by medical studies. This contention, though unanswerable in theory, is untenable in view of its practical results. Medical education of the present day does not confer on general practitioners the degree of competence in stomatology and dentistry possessed by specialists, and wherever the former have taken the place of the latter permanently, the results have been far from satisfactory. "Heinrich Heine, the poet, when he was on his mattress-grave suffering from a terrible form of paralysis, used to spend a part of his time in reading medical books about his disease, and, according to Mathew Arnold, one of his friends asked him one day what advantage he supposed this reading would be to him. His answer was that he was preparing to give a lecture in heaven as to the want of knowledge of the doctors on this earth concerning the diseases of the spinal

[1] The New Army Law of the United States which was approved by the President, Feb. 2d, 1901, in Section 13, authorizes the appointment of military surgeon dentists for the army in the proportion of one dentist for every thousand men. The English war office has lately sent four dentists to the army in South Africa, and the British Dental Association was consulted regarding instruments, appliances, &c. (The Lancet, June 8th, 1901, p. 1615.)

marrow."[1] These words, which I have copied literally from a work published by Dr. Malcolm Morris and which this dermatologist finds applicable to our knowledge of eczema are also perfectly appropriate to the excursions of doctors in the field of dental pathology and therapeutics. On the other hand, what was called the art of the dentist constitutes now a true science which stands nearly at the height of perfection, particularly in the schools of this great Republic. The old saying, "He lies like a tooth-puller," should be abolished as regards the specialist of our times. That profession at the present time is based on thorough preparatory and classical instruction which is completed in extensive courses of medical studies and practice. The excellence of the knowledge that is acquired in dental colleges by means of books or oral methods and demonstrations on the anatomy and physiology of the mouth, its pathology and therapeutics, on the special surgery and laboratory operations which form the "in therapaia mechanicum," that is, the dental prothesis makes this specialty one of the most beneficent. Few there are that possess such powerful elements for the protection of health and that confer, to such a degree, physical welfare and the joys of existence even in the sad period of decadence. When age advances the vital powers begin to diminish and all our organs, especially the digestive, languish, leaving us extremely sensitive to morbid influences. Hence the skillful and conscientious operator, the studious professor who contributes to the cause of science, the artist acquainted with the principles of dental asthetics, exercises such a wholesome influence and is respected by the members of other professions; hence, also, the valuable cooperation of his services is an indispensable element if we wish to attain to the old ideal of education—"Mens sana in corpore sano."

[1] A clinical lecture on eczema in relation to age, delivered at the Medical Graduates' College and Polyclinic on Jan. 9th, 1901.

THE INFLUENCE OF SCHOOL LIFE OVER HEALTH.

By FRANK W. WRIGHT, M. D., New Haven, Conn.

The influence school life has over the health of pupils should interest not only physicians and those actively engaged in school work, but all parents who desire their children to arrive at maturity with their physical as well as their mental powers well developed and equipped to meet the struggles of life. Undoubtedly the seeds of many of the ills of those of mature age are sown in the schools, and it is highly probable that many of the failures of adult life are due to the slothful dispositions and indolent habits engendered by badly ventilated and poorly lighted school rooms, in which they, as children, have spent many hours, supposedly improving both their physical and their mental endowments.

The first principles of school hygiene are embodied in the selection of the sites for the school houses and the construction of the buildings and furniture as regards ventilation, light, the positions the pupils must maintain during school hours and the sanitary requirements. Concerning these, the physician is never consulted, and seldom the sanitarian. In cities and large towns some consideration is given to these requisites when a school house is about to be constructed, but in the small towns the school house is usually placed where the land is least available for other purposes, and the building is such as will receive the approval of the most conservative taxpayer.

In selecting a site for a school, proximity to marshes and unsanitary surroundings should be avoided. A high position is desirable and the ground should be dry by nature or by properly constructed drains.

The construction and furnishing of school buildings can not be fully discussed in this paper as the details are many and technical, but it is necessary that some of the essential features be mentioned.

The buildings ought not to be over two stories high, with wide and well-lighted halls and stairways. The floors and all woodwork should be closely joined, in order that dust and disease germs may find no hiding places. A cellar should be under the whole building. The walls may be tinted, but the ceilings should be white. If heated by a furnace, care should be exercised that the cold air taken in is free from all possible contamination. Forty or fifty pupils are as many as should occupy any room, and about twenty cubic feet of air space should be allowed for each person occupying the room. I believe that, with proper care, a room can be better ventilated by the natural

air circulation than by any of the elaborate systems for artificial ventilation. Light should be introduced from the left of the pupils, and a northern light is preferable. The area of glass should be about one-fifth of the floor area. Water-closets should never be in the basements, but should be placed at convenient distances from the school houses and have covered approaches. Desks and seats should be so constructed that the front edge of the desk will be upon a line perpendicular with the edge of the seat, which should be of such height that the pupil's feet may rest flatly upon the floor. The top of the desk ought to be about even with the elbows and slightly sloping.

The diseases most common to school life are near-sightedness, deformities of the spine, disorders of the nervous and digestive systems, tonsillitis, consumption, and the contagious diseases of childhood, such as scarlet fever, diphtheria, measles and whooping cough. It has been found by the examination of the eyes of many thousand children in the high schools of Europe, that over 40 per cent. were near-sighted to a greater or less degree. It was also found that the defect increased from the primary to the higher rooms not only in frequency but in degree. The causes of this trouble are badly arranged and insufficient light, bad air, improperly constructed desks, and badly printed text-books. One investigator found that in the more modern school houses, where more attention is paid to the light and arrangement of the seats, that the proportion of pupils with defective eyesight is less than among those of the older school houses.

Curvature of the spine is quite common among school children, and can nearly always be attributed to the positions assumed by them on account of improperly constructed desks and seats. A much larger proportion of girls have spinal deformities than boys. A prominent cause for this is the fact that the clothing of girls hangs loosely about them, and when they are seated tends to gather into irregular pads, raising one hip higher than the other. They also, when at study, are more inclined to assume twisted positions than boys.

Nervous disorders, such as headaches and hysteria, are not at all infrequent, and affect the teachers as well as the pupils. Girls, again, are more subject to these disorders than the children of the opposite sex. Impure air, defective light and mental strain are accountable for these troubles.

Disorders of the digestive system with which many school children are visited, are caused by poor food, cold lunches, eating nuts and sweets and neglect of the calls of nature. One of the important factors in the causation of disturbances of both the nervous and digestive systems I believe to be too long school hours. In my opinion, many of the failures in health and scholarship among the pupils of our high

schools are due to the hours. A session of three hours, with a short intermission, is as long as any growing person should work. The hours most of the high schools are in session require an early breakfast and a late dinner. Often the latter is long after the rest of the family have dined, and the food is either cold, or warmed over and not palatable. From personal observation I am certain that the exercise and refreshment taken during the intermission are not of the right nature. Those that take exercise do so with the same clothing that they wear in school and with uncovered heads, be the weather fair, cold or damp. The lunches are largely of sweets and other indigestible foods. These not only cause digestive disturbances, but prevent keen mental activity.

It seems certain that many who develop consumption later in life have the way paved for this disease during their school life by overcrowding, bad air, over-heating, and cold draughts of the school rooms, by neglected coughs, poor nourishment, etc. I believe the surest way to correct this is to employ only healthy teachers and to give delicate children accommodations by themselves.

Tonsillitis is often epidemic in schools and is contagious. It is very apt to prevail at the time diphtheria does and may be confounded with it. Special care should be taken that children who have had the latter disease do not return to school and report that they have been sick with tonsillitis. It will be impossible to always prevent this, as the clinical symptoms of both diseases are very similar and the most conscientious physician may be mistaken. A bacteriological examination alone surely establishes the correct diagnosis. Tonsillitis may be caused by poor ventilation or by sewer gas that has escaped into the room.

The diseases that are most frequently brought to the teacher's attention, and that often cause serious alarm, are scarlet fever, diphtheria and measles. These diseases are never contracted from defects in the construction of the school building, nor even from poor ventilation or escaping sewer gas, but each of these may lend material aid towards rendering persons susceptible to the contagion of any of the complaints. No one of these diseases can be contracted in the school room except by some person bringing into the room the particular micro-organism that is peculiar to it. This may be by the person who has been sick, returning to school before sufficiently recovered, or before his person and clothing have been disinfected, by other members of the family attending school or by persons residing in houses in which contagious diseases exist, unless great care is taken in isolating the patient and in disinfecting the articles likely to be infected.

Physicians, sanitarians, architects and school boards are at the present time seriously considering how sickness among school children may be lessened, and as a result of this, the hygiene of our schools must improve, but the good accomplished will be more noticeable in years to come when statistics for several decades can be compared.

The first great care, when schools are assembled, is to see that all, both pupils and teachers, have been successfully vaccinated. If we allow children to pass into adult life unvaccinated, we are raising a population that are liable, at any time, to contract a disease that, previous to the discovery of vaccination, killed more people than all other diseases together. At the present day it is well known that communities where this has been neglected suffer more from this scourge than those where vaccination is compulsory. It is of the greatest importance that not one person connected with a school should be in the least susceptible to smallpox, as a single case would cause a panic that would not be confined to the school in which it occurred, but would so interrupt the usefulness of all of the schools of a city or town, that it would be many months before anything like systematic work could be resumed. Children who have not been vaccinated during infancy should be before beginning school, and again when they are twelve or fourteen years of age, and the dates and results of such operations should be made a part of the school record.

No child from a family in which a contagious disease exists should be allowed to attend school, and no child from the same house should do so until some person, whose duty it is to personally investigate, certifies that all due precautions have been taken by isolation and by disinfection of all articles exposed to infection, and that the one receiving the certificate has been free from exposure to the disease. Any person who has been exposed to a contagious disease should not attend school for at least two weeks from the last known exposure.

A person who has been sick with scarlet fever should be kept from school until at least the process of desquamation has been completed, and even then he should not return until there has been a thorough disinfection of the person and premises.

Many seem to believe that when, in a case of diphtheria, the membrane has disappeared from the throat, the danger of its being communicated to others is past. I am certain that outbreaks of this disease often have their origin from persons who have been allowed to return to school before their throats have become free from the Klebs-Löffler bacilli. As a bacteriological examination of cultures made from the throat is necessary to establish a positive diagnosis, so is it necessary to positively prove that the bacilli have left and the danger

past. Disinfection after this complaint is of the same importance as after scarlet fever.

Measles and whooping cough are diseases that do not receive sufficient attention, especially the latter. Measles is a dangerous disease unless the best of care is given to the sick. Fatal attacks of pneumonia and bronchitis are frequent complications of measles, and many other complaints may be more or less directly due to it. Children who have been exposed to measles need to be isolated fully as much as those who have been exposed to scarlet fever or diphtheria, as in measles the danger of contagion is probably greatest during the catarrhal stage, which usually precedes the eruption by about four days.

It is frequently stated that whooping cough is but a trivial disease, and that all children should have it while young and be through with it. To my knowledge teachers have within a few years made the statement that "having whooping cough was no excuse for being absent from school." Such opinions and teachings are not only erroneous, but extremely dangerous. I regard this disease as one to be shunned as much as possible. While whooping cough is not particularly fatal to older and robust children, it may be contracted by them at school and by them communicated to other members of the family. It is a very fatal disease to young and delicate children. During the year 1898, the year whooping cough was last epidemic in New Haven, there died in that city from this complaint about one-third more than there have from scarlet fever in the last eight years.

Any disease that can be contracted at school and carried to the home should be most rigorously excluded from school and teachers should refrain from giving advice at variance with this policy. No invariable rule as regards the length of time one who has had a contagious disease should be kept from school can be given, as all diseases vary in severity and duration. I am of the opinion that a person who has had scarlet fever can resume his usual avocations, provided disinfection of person and home has been thorough, at the end of seven weeks, diphtheria four weeks, and measles two weeks. It sometimes happens after any of these diseases, that the time above given is not long enough, and often a person may safely associate with others in a much shorter time.

It should be forcibly brought to the attention of teachers, that all rules for the protection of the health of the children should apply to them as well as the pupils.

I deem it of the greatest importance that the pupils should have nothing in common, as it is well known that children with contagious diseases often attend school for several days before it is discovered

that such is the case. It has been conclusively shown that diphtheria can be communicated by means of pencils, drinking cups, books and clothing. Most of the attempts that I have seen to keep separate these articles, have been but a delusion. Each child should have books used by no one but himself, and when the books have become dirty or infected should be destroyed. One of the bright young teachers of the writer's own city has devised a cap for pencils that is superior to anything known of by him for preventing the liability of contagion being spread by this means. This cap is about one and a half inches long and is made of alluminum with an alloy of some metal hard enough to make it unpleasant to bite. This can be easily wiped with a disinfectant. A number is stamped into the top which preserves the individuality of the pencil. New Haven has also the honor to have manufactured within its limits the only sanitary drinking fountain of which the writer, after diligent inquiry, can learn. It is impossible to intelligibly describe this, but it is so constructed that a column of water is raised with more or less force as required, in such a manner that the smallest child can readily drink without inconvenience and without soiling his lips with anything that has been touched by another. I have viewed with pleasure the coat rooms of some of the modern school houses, that are so constructed that the hats and coats of the pupils are kept entirely separate from those of each other.

Medical inspection of schools, if properly performed, seems to offer more possibility towards lessening sickness among the young, not only at the school, but in the home, than any plan yet adopted. This can best be done by making four classifications of the subject, viz: First, sanitation of the buildings, which should include the inspection of closets, urinals, heating and ventilating apparatus, lighting and the general cleanliness of the rooms and halls, the water supply and means by which this is served and possibly supervision of books, pencils, etc., as to neatness and disinfection or destruction if necessary; second, examination of pupils, which should be daily for the prevention of contagious diseases and at stated intervals for the detection of parasitic diseases and vermin, and at least once every term to ascertain if all pupils have been successfully vaccinated; third, the examination several times a year of the eyes and ears of each pupil, that errors in refraction of vision may be corrected and defects in hearing may be treated. Many a child naturally bright has been considered hopelessly dull, simply because no one had discovered that that was a defect in his sight or hearing; fourth, what may be called outside inspection; that is, investigating into causes of absence of children from school and if they are found to be sick, the nature of their illness. The custom of sending children from the schools for this

purpose is very wrong and should not be allowed. I have several times been present in houses in which there were contagious diseases, when children have come from the schools and were intending to return immediately and have known them to be invited in to wait, which they would have done except that I prevented it. I am convinced that in this manner contagion is sometimes conveyed to the schoolroom. It is plainly the object of medical inspection of schools, not only to exclude those actually sick, but to use all means to preserve the health and happiness of the pupils and their relations and friends at home.

The increased agitation by sanitarians, within the past few years of this important subject, school hygiene, has awakened an interest among the parents of children that attend the public schools, and they are now expecting precautions against diseases by health and school authorities, that ten years ago had not even been considered possible. I know of no more tangible results that can be obtained from the labors of local health authorities than by attention to school hygiene. It is therefore necessary that local health boards and their employes cultivate by efficient performance of their duties, the interest the people now exhibit in this branch of sanitary science, that the work may not alone be passively endured, but be of such demand, that sufficient appropriations for this purpose can not be denied by the financiers of the local governments.

A SUMMARY OF A PAPER BY DR. IGNACIO GUZMAN ON THE ADVISABILITY OF ENTRUSTING TO PHYSICIANS, AND NOT TO TEACHERS, THE MEDICAL SUPERVISION OF PUPILS.

Although the comprehensive curriculum of normal schools enables the teachers in our time to realize fully the structures and working of the human body, that knowledge cannot possibly be called *medical* and it would be as preposterous to ask teachers to diagnose and doctor the ailments of their pupils as if a student or professor of physics were requested to drive an engine because he was acquainted with the properties of steam. Such a supervision cannot properly be carried out by anybody unless he be a duly qualified physician. But if everything should be done by the unaided physician that would require such a staff of properly qualified practitioners that their appointments would be beyond the possibilities of many a budget. Naturally the aid to the physician must come from the teacher, and in order that he may be enabled to give an effective help his knowledge must not only increase but it needs to be properly trained. So, in the belief of the author of this paper, teachers should be trained to help the inspecting physician in work of the following kind:

First. Anthropometrical statistics.

Second. Diseases produced by ill-directed school work.

Third. Contagious diseases in the school and how to deal with them.

Fourth. Examination of the physical conditions of pupils at the time of their entrance to school, that examination being repeated several times afterwards at stated intervals.

The teacher should compile and carefully preserve all these records, and the physician ought to use these notes to test the truthfulness of the already admitted principles and to inquire after new ones.

REPORT OF THE COMMITTEE ON DEMOGRAPHY AND STATISTICS IN THEIR SANITARY RELATION.

The Committee on Demography and Statistics has at present under consideration two important subjects upon which it is not at present prepared to make definite recommendations to the Association.

The first concerns the essential features of an effective law for the registration of births and deaths.

It is the experience of those who approach the legislatures of non-registration states upon this subject that in the beginnings of registration the sanitary and statistical data are the only features of registration which impress the legislators.

Thus it happens that, for want of certain fundamental provisions, registration laws often fail to produce full returns of the data which the sanitarian needs primarily, while they wholly overlook the important legal relations of records of birth, death, marriage and divorce with their bearing upon the private interests of the citizen.

The development of the registration idea has in different areas followed only a general direction and presents very many variations. Your committee proposes therefore to formulate the correct outlines of a registration law, emphasizing the essential features and indicating in the order of their importance those data which are demanded in the legal and private aspects of registration. The record of death has been generally recognized as of first importance in registration, and your committee has therefore set as its second task to prepare and present at the next or a future meeting a model form of record of death.

Your committee has already in hand considerable material representing the views and practice of various registration officers, and has to acknowledge its indebtedness to the U. S. M. H. S. and to the Federal Census Bureau for valuable aid and advice.

JOHN S. FULTON, Chairman.
CHARLES V. CHAPIN.
CRESSY L. WILBUR.
HENRY M. BRACKEN.
WILLIAM H. WELCH.
W. C. WOODWARD,
M. N. BAKER.

SOME OF THE CAUSES OF INFANT MORTALITY IN NURSERIES AND ASYLUMS, AND THEIR PREVENTION.

By Dr. ELIAS H. BARTLEY, Brooklyn, N. Y.

It is an accepted fact that infants and young children do not thrive as well when congregated in nurseries as they do in the ordinary home.

The mortality of infants in these asylums is well known to be high. Among foundlings it is, in some of these institutions, simply appalling; so much so, that it is a rare thing for one of these unfortunates to survive the first year. There can be no denying the fact that the mortality is greater in the municipal institutions than in those managed by independent or private charitable organizations. A part explanation for this difference has been assigned to the fact that many of those sent to the public or municipal institutions are foundlings who have been neglected and exposed to inclement weather, and therefore in bad condition when received. Others are handicapped by a syphilitic or tubercular taint. This explanation, however, does not reasonably account for all of the high mortality, for the same argument applies to many of the infants received by the smaller private institutions.

It is very difficult to get accurate statistics of these institutions, giving the mortality during the first year of life. The mortality statistics are published as a whole, but no attempt is made to separate those under one or two years from the older ones. The deaths under one year are, of course, much more numerous than in after years. In one institution in New York, whose regulations limit them to children under two years, the mortality for 1897-8 according to the report of the State Board of Charities, 1899, p. 429, was 40.35 per cent. In three other institutions where no special limit is mentioned, in the nine years from 1889 to 1898 inclusive, the average mortality was 17.27 per cent., 21.69 per cent. and 27.85 per cent. respectively. If the average death rate among children in the whole city be taken as a standard, (*i. e.*, 26 per cent. for first year) we can readily see that the death rate of 27 per cent. is slightly higher than the average death rate for children outside of the institutions, on the basis of those under one year of age. For the institution caring for those under two years of age, the mortality is 14 per cent. higher than for the whole city. This means that out of one hundred children cared for by this institu-

tute, sixty of them will be found alive at the end of the year, while of one hundred ordinary infants cared for at their homes, seventy-five of them will be found alive at the end of the year.

After a very considerable study of the statistics so far as I have been able to get them, I am convinced that these figures represent about the relative difference in the mortality between private care and institution care, for the whole of the population. It must be remembered that these statistics take in the whole city, with its vast tenement population, where the death rate in hot weather is often greater than in the institutions. If this tenement house element could be stricken out, and we should take only the intelligent and ordinary care in the average family, the mortality would be about 16 to 20 per cent. Viewed in this light, the difference in the two methods of caring for infants becomes more apparent, and demands a careful inquiry into the causes of the high mortality in these institutions.

The causes that have been suggested are:

1. The inherited or acquired weakness of constitution, such as syphilis, tuberculosis, rachitis, starvation, exposure, etc.

2. Infectious and contagious diseases, which are more serious because of the conditions.

3. Overcrowding, insufficient ventilation and cleanliness.

4. Insufficient care, or cruelty, on the part of nurses.

5. Improper care and attention to the diet.

The first of these causes is a potent one and is not, as a rule, within control. The best that can be done with such cases is to give them the best chance in the way of care, feeding, warmth and fresh air that science can suggest.

The critical period with many of the foundlings is the first week after their reception. A little extra care during this time may be the means of saving them. The use of the incubator may be of advantage, or a specially warmed room, in cold weather. The food should be adjusted to the age and needs of such children with the greatest possible care. This applies not only to the weakly, but to all infants.

2. Contagious diseases, in spite of all precautions, will occasionally be brought into the institution.

All children when received should be placed in a reception ward and detained for ten days, under strict observation, before being distributed. This ward should be in a part of the building as far removed as possible from the other wards, or if possible in another building. Should a contagious disease appear, the child should be at once transferred to the hospital ward. This isolation should apply not only to the usual contagious diseases of childhood, but to ophthalmia, eczema, impetigo, ringworm, la grippe and the diarrhœas. The quarantine

regulations should be made as rigid as possible, and all communications between the sick and well children should be absolutely cut off.

Both the direct and the indirect results of these contagions are so serious, among institution children, that no pains taken to prevent their extension should be thought too much. Where the children are properly housed, and are regularly kept in a pure air, and allowed plenty of outdoor air and sunshine, epidemics may be borne by the average inmates of an asylum quite as well as those living in homes. There will always be a considerable number, however, who are already the subjects of rachitis, tuberculosis, and bad general constitutions. Such are non-resistant to any acute illness. The eruptive fevers are apt to carry off many institution children, either during the acute attack or by some complication or general failure of health and decline after the acute disease is over.

3. Overcrowding. This is a well recognized cause of sickness and mortality in infants and young children. In the State of New York the State Board of Charities attempts to control this by restricting the number of children in the institutions of the State. Each institution is informed by them as to the number of children they shall admit, as determined by the measurement of the room space at disposal. This is a beneficent measure and should be strictly enforced.

Four hundred cubic feet of space should be allowed each child, and six hundred feet for nurse or care taker, *i. e.*, in a room twelve feet square and ten foot ceiling (10 x 12 x 12—1400 cubic feet) will afford space for two small children and one nurse. If the light and ventilation be good, three infants and a nurse might be allowed.

Free ventilation by windows open at the top and bottom in summer should be insisted upon. In winter open grate fires are the best ventilators. No baby smell should be tolerated in the air of nurseries. Such odors will develop unless due care be taken with the ventilation, and small children will not thrive in such an atmosphere. Where ventilation will not prevent such contamination, it has been the practice of the author to remove the children from the room and disinfect the air, walls and furniture with chlorine, sulphur fumes, or formaldehyde. This may be done in a few hours, and in some rooms it may have to be done once or twice a week. Usually, however, once a week, for a few weeks, followed by strict supervision of the ventilation, and proper care of the linen of the infants will suffice. In warm weather the killing of the flies by the fumigation is a matter of considerable value from a hygienic point of view, as they are carriers of various infections from one child to another. Flies should be carefully excluded from the wards. I cannot insist too strongly that the air shall be untainted by this peculiar baby odor. In times of epidemic of any kind this

disinfection should be practiced at least once a week, or better twice a week. I have a number of times seen an epidemic which began in a severe form, soon become mild under such a practice, and in such diseases as diphtheria and scarlatina, will usually confine the contagion to the first few cases, provided that the sick ones can be removed to another room, even an adjoining room. Another matter of importance in this connection is the method of dealing with linen of the infants. In all disturbances of the intestinal secretions in infants, even if not of bacterial origin, at the beginning, the discharges will soon become the seat of active bacterial decomposition. In all such cases the infant should be taken from the room into the bath room to be changed, and the diaper should be thrown at once into some disinfectant solution. It is a well-known fact that unless unusual care be taken in this respect, the disease will be communicated to all the other infants and small children in the same ward. The infectiousness of the summer diarrhœas can not be doubted, and is generally recognized. By proper care as to disinfection, not only of the diapers, but of the hands of the nurse this can be prevented. I have repeatedly seen a case of putrid intestinal fermentation come into a ward and infect all the infants in it. I have satisfied myself of the value of disinfection of the whole room and bedding in such an accident. When possible, every child suffering with putrid stools should be isolated, or sent to the hospital ward. I am of the opinion that no ward of a nursery should contain more than three infants. This means that the wards should be small, not exceeding 2000 cubic feet (12 x 16 x 10—1920 cubic feet). Or, perhaps it may be better to have two such rooms, connecting, to accommodate two nurses and six infants. No nurse should be expected to attend to more than three infants, or, better, two infants and one old enough to walk about and help itself somewhat. To be sure, this is not the most economical method, but it is the only safe method. I have seen one woman assigned to the care of twelve to fifteen bottle-fed babies. The death rate in this case was simply appalling. No one woman can care for this number of babies, and keep them well. They can at best change the position of the infants only at long intervals. The air of the room, in this case, was loaded with the odors of sour milk, ammoniacal urine, soiled diapers, and the noise of the constant crying of from two to five babies. A moment's thought would determine why these babies nearly all died during their first year. When a nurse has ten babies to care for, and they are to be fed every three hours, she cannot spend any time in supplying the place of a mother. The babies must spend nearly all their time in the recumbent position, with no exercise except what they get in using their lungs, and in the act of sucking. The little

exercise they get in being taken up to be bathed and cleaned, can not exceed two hours out of the twenty-four. This lack of exercise alone must lead to digestive disorders, lack of stimulus to the circulation, with cold hands and feet, constipation and hypostatic congestion of the lungs and other organs.

Fresh outdoor air is a *sine qua non* in the management of infants as well as of older children. All well infants should be kept out of doors as much of the time as the weather conditions will permit. This can be done only where a sufficient number of nurses are at hand. If the building be constructed so that the rooms are small, that is, so that a nurse has under her care two infants and another able to walk, it will be possible for her to keep them all out of doors in the yard a considerable portion of every clear day, winter and summer. This important matter is very generally neglected in most infant asylums. Even the unprofessional know the resistance gained by this simple procedure of plenty of fresh air and sunshine.

The Feeding. During the first two years of life the digestive apparatus is sensitive, and very liable to severe disturbances. This is especially true of children whose powers of resistance are enfeebled by disease or unsanitary surroundings. Errors of diet are liable to set up fermentative processes in the intestines which may be serious.

As above stated, these disturbances become infectious and communicable to other children. We cannot always tell why benign bacteria become, at times, virulent, and why at one time their toxins are so active, and at another are comparatively harmless. That such a modification in virility does take place in the bacillus coli communis, for example, is well known. Errors in diet seem to play an important rôle in this modification. Improper food, or food unsuited to the age and digestive powers of an infant will produce indigestion, and catarrh of the mucous membrane of the stomach and intestines, with an excessive secretion of mucus. It is a well-known fact that catarrhal mucus affords an excellent nidus for the multiplication of bacteria. Moreover, the diseased membrane loses its power of keeping back these organisms, and, as has been shown, allows them to enter the circulation and thus produce the severe symptoms of acute gastro-enteritis, or the collapse of cholera infantum. Correct feeding, then, is of the greatest importance in the maintenance of health and the preservation of the life of infants and young children.

It is certain that infants cannot be kept in good health by mechanical routine methods of feeding. They cannot be reared by artificial feeding without more trouble than the most of our infant asylums seem willing to take. These infants and small children cannot be treated like ordinary boarders, but must receive special care and watch-

fulness. The average hireling care-taker will need careful watching. A conscientious matron is an essential to success with infants. Such a one will see slight ailments and have them attended to early. It is these little things that make up a successful nursery, and not the pneumonias, and the surgery. In the matter of diet, my observation leads me to say that most institutions are too much concerned with economic considerations, rather than with the best interest of the children. The price charged for the board of infants is from $6 to $10 per month. That is, from $1.50 to $2.50 per week. When properly fed, the food of a child six months old will cost about $1 per week. Perhaps in feeding a large number it may be reduced to eighty-five cents. This only includes the cost of the food. It does not include the nipples, bottles, care, housing, clothing, administration, heat, light, and other expenses. It is easy to see that economy must be practiced to make ends meet. In the municipal institutions the economy is even more insisted upon than in the private institutions, to the great detriment of the nutrition, health and life of the little ones. Without entering into a general discussion of infant feeding, we may lay down the following axioms:

1. Breast feeding is the best method of feeding infants during the first nine months.

2. Where breast milk is not obtainable, the food should be as nearly like it, in composition and properties, as possible.

3. Modified cow's milk is the only available food that can even approximately imitate breast milk.

4. Sterilization and pasteurization of milk are both injurious to the milk, and are at best but apologies for dirty milk. Theoretically and practically, both of these processes injure the milk as a food for infants.

The best modification of cow's milk consists in removing a part of the caseinogen, increasing the soluble albumin and sugar, warming to blood heat and making it slightly alkaline. The process should be capable of being modified so as to vary the constituents of the food to suit the individual needs of the infant. The food should be prepared by a trained assistant who is intelligent and conscientious enough to carry out the directions of the physician. A diet kitchen is a necessity in every nursery, and all the food for babies should be prepared and kept here until needed, and a record should be kept of every child's ration. The one who prepares the food would thus be responsible for the food of each child, and see that the proper quantity and quality was dealt out.

The method of modifying milk for infants which is in use at the Sheltering Arms Nursery, Brooklyn, and which has given great satisfaction is as follows:

The milk is obtained in bottles, and is the best obtainable. The milk served in bottles is already creamed, and has been subjected to less exposure and shaking than that transported in cans. In larger institutions it may be necessary to use the milk brought in cans, and allow it to stand four hours in a special can holding several gallons, and provided with stopcocks allowing one to draw off one-half, two-thirds and three-fourths of the contents from the bottom of the can. The following description applies to the preparation of a day's supply of food for one infant of two or three months of age.

Siphon off from the bottom of a bottle of fresh milk of good quality three-fourths of its contents, leaving the cream and upper part of the milk undisturbed in the bottle. This may be easily done with a small glass siphon or rubber tubing, previously filled with water, to start the siphonage. Pinch one end of the rubber tube and hold it firmly, while the other is thrust through the cream and to the bottom of the bottle. Lower the outer end into the inner vessel of an ordinary double boiler, and release it, when the skim-milk will run out, provided the latter vessel is kept lower than the milk in the bottle. To the milk thus drawn off, add a teaspoon and a half of a good essence of pepsin, and warm slowly in the double boiler to blood heat, and keep at that temperature until thoroughly curdled. Now heat, with constant stirring, until a thermometer dipped into the milk shows a temperature of 155° F., and remove from the fire. Strain, while hot, through clean wire strainer and dissolve in the whey a heaping tablespoon of sugar of milk and the white of one *fresh* egg.[1] When cold, pour the sweetened whey back into the milk bottle, and mix thoroughly with the cream and top milk. Should this food prove too laxative, reduce the quantity of milk sugar. It is well to add, at the time of feeding, from one to two teaspoonfuls of lime water to each meal. As the child increases in age and strength the amount of bottom milk siphoned off may be diminished.

One great benefit of this process is its pliability, or the ease with which the constituents may be varied. If we wish to reduce caseinogen, we draw off more of the bottom milk. To increase it, draw off less. To decrease the fat, dip off a part of the cream, remembering that the whole amount of cream measures from ten to twelve tablespoonfuls. To increase the fat, add a little less than the full amount of whey, after removing the curd. To increase the soluble albumin, add more white of egg. The sugar may be varied at will, by adding more or less, as desired.

[1] Where absolutely fresh eggs can not be obtained it is best to omit this, especially in hot weather, as stale egg albumin will often produce putridity of the stools.

The intelligent use of such a food has given excellent results in my hands, and has saved the lives of many infants. In fact, acute summer diarrhœa is a rare occurrence in the nursery above mentioned. During the past summer no case of this character has occurred. Cleanliness, careful watching, occasional fumigation with sulphur to kill the flies and sweeten the air, intelligent feeding and plenty of outdoor air have accomplished this result, and I firmly believe it will do the same in any institution where proper attention is paid to these common sense rules.

SUMMARY OF A PAPER ON CREMATION IN RELATION TO SANITARY LEGISLATION.

By Dr. LUIS G. ESPINOZA, Veracruz, Mex.

Summary of Espinosa about the advantages and drawbacks of both cremation and inhumation.

The comprehensive scope of this paper does not admit of a too abridged summary which would deprive it of its precision and clearness. The author has not forgotten any of the principal arguments which tell for or against each of those methods. He divides his study in three parts: The first one is a discrimination about the drawbacks and merits of cremation; the second establishes the hygienical regulations of cemeteries, now existing, and tries to discuss their respective value. Last, he, after due consideration, concludes in favor of compulsory cremation in case of infective disease, and of inhumation for the rest.

SOME RESULTS OF THE ARMY CANTEEN OR POST EXCHANGE, FROM THE STANDPOINT OF DISCIPLINE AND HYGIENE.

By EDWARD L. MUNSON,

Captain, Assistant Surgeon, U. S. Army.

As a medical officer of the regular army, permit me to briefly invite the attention of the members of this Association to some results of a statistical study made by me with respect to the influence of the Army canteen, as it existed prior to the passage of recent legislation curtailing its operation, upon the health, morals and efficiency of troops. The figures upon which these statistics are based were secured from the published reports and official records of the War Department, and can be readily verified by those interested.

The canteen system was first authorized by the War Department in the year 1889, and during the next two years it gradually supplanted the old system of sutlers, and post traders, stores throughout the Army. An excellent idea of the apparent effects of the system can thus be obtained by comparing the seven years 1885-1891, before the canteen system was thoroughly established, with the six years, 1892-1897, after this system had come into general operation. The years 1898-1900 are not included, since, although they show an even more marked improvement than the last period mentioned, which is apparently only to be attributed to the beneficial influence of the canteen, it is thought that conditions of peace cannot properly be compared with those of the active service of the past three years, and hence these years are left out of consideration. Figures for the periods first named would appear, however, to be sufficiently conclusive.

With respect to admissions to sick report for alcoholism, the rates for the decade, 1878-1887, amounted to an average of 64.28 per thousand strength. This rate diminished, as canteens were gradually established throughout the Army, omitting fractions, as follows: 46, 44, 44, 41, 37, 34, 32, 31, 30. Comparing the whole period, 1885-1891, with the whole period, 1892-1897, the average number of admissions to sick report was reduced by 23.6 per cent. In 1890, there were seventeen Army posts at which the admission rate for alcoholism exceeded 10 per cent. of the garrison strength. In 1891, the number of such posts had decreased to eleven, and in the following years diminished at the following rate: 10, 7, 4, 5, 2, 2. As a single instance, in

1889 the post of Willet's Point had an admission rate of 222.97 per thousand strength. For 1890, during which year the canteen was established at that post, the rate fell to 157.50, and in 1891 was further reduced to but 70.46.

The gravity of the cases of alcoholism was also reduced through the influence of the canteen; the rate for cases of delirium tremens for the period of 1892-1897 showing a diminution of 31.3 per cent., as compared with the seven-year period before the canteen was established.

For the same periods, also, the rates for insanity were reduced by 31.7 per cent., and the number of days of service lost to the Government, from this cause, was decreased by 40.9 per cent.

For the year ending June 30, 1898, the profits of the post exchanges in operation throughout the Army amounted to a total of no less than $323,661.51; which sum was returned to the men and expended to improve their food, purchase reading matter and gymnasium and athletic equipment, and in other ways make their lot more comfortable and the military service more attractive. The effect of this betterment of conditions was at once shown in a remarkable decrease in the rate of desertions; the percentage of these being 9.18 for the period 1885-1891 and but 4.53 for the period 1892-1897. This reduction in desertions was practically progressive as post exchanges were established throughout the Army—the rate of desertions for the two years prior to the war with Spain being scarcely one-fourth as great as the rate for the three years immediately preceding the introduction of the canteen system into the Army. As each United States soldier costs the Government $1,014.66 annually, this decrease in desertions meant, for those years, a money saving to the Government of more than two million dollars.

The number of soldiers depositing with Army paymasters for the period 1892-1897, as compared with the average for the pre-canteen period 1885-1891, increased by 13.3 per cent.,—a deposit by the soldier being practically a bond for the good behavior of the latter and his continuance in the service.

Finally, the establishment of the canteen was followed by an extraordinary diminution in the number of convictions by courtmartial for drunkenness—the pre-canteen period mentioned having an annual average of 372.5 such convictions, while the annual average for the same cause after the canteen system was established was but 160.6. The year before the canteen system was established the convictions by court-martial for drunkenness numbered 423; in 1894, the third year after the system had been generally established throughout the Army, they had fallen to but 120.

Much might be said to show the remarkable influence which the canteen—with its restricted sale of beer and light wines—has had in preserving the health of troops, maintaining discipline and promoting temperance; but in view of the figures above given further argument on this subject would seem to be unnecessary. The canteen, as formerly operated, was a positive element for good. It was so regarded by 95 per cent. of the more than six hundred officers of the Army who have made reports concerning its influence to the Secretary of War. Its misguided opponents could merely oppose theory to facts and sentiment to statistics. Backed by political prestige, theory and sentiment have temporarily succeeded in destroying an institution whose influence was wholly beneficial—much to the sorrow of those who have the true interests of the soldier at heart, and who must treat with human nature as it exists in the Army, rather than attempt the attainment of impossible ideals.

ANTI-RABIC DEPARTMENT OF THE SUPREME BOARD OF HEALTH OF MEXICO.

By Dr. EDUARDO LICÉAGA, Mexico, Mex.

Report of cases attended in the Anti-Rabic Institute, from the 23d of April, 1888, to the 31st of August, 1901:

	1888	1889	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901
Inoculated from animals proved to have rabies	7	25	26	18	15	17	30	30	27	20	38	27	24	8
Inoculated from animals that were probably diseased	15	55	75	91	80	93	117	201	279	239	254	275	300	140
Inoculated from suspected animals	24	46	72	66	95	63	119	94	120	103	121	94	226	189
Total	46	126	173	175	190	173	266	325	426	362	413	396	550	337

Number of cases of inoculation from animals proved to have rabies..... 312
" " " " " probably diseased..... 2,214
" " " " suspected animals..... 1,432

Total..... 3,958

In spite of the treatment, 12 persons, amounting to 0.30 per cent., contracted hydrophobia and died.

Persons not included in the above table, though abandoning the treatment:

Desisted in the course of the first series of injections..... 236
Desisted after the first series..... 135
Desisted after the two first series..... 119

Total..... 490

Number of rabbits inoculated in series..... 3,803
Number of transmissions of virus..... 564

Period of incubation—four days.

The above data were collected by Dr. Ismael Prieto, Chief Physician of the Anti-Rabic Department. This department is under the charge of a committee of the Supreme Board of Health, consisting of Dr. Fernando López.

OFFICIAL REPORT OF THE PROCEEDINGS OF THE TWENTY-NINTH ANNUAL MEETING OF THE AMERICAN PUBLIC HEALTH ASSOCIATION.

Held at Buffalo, N. Y., September 17, 18, 19 and 20, 1901.

September 17th—First Day—Morning Session.

The Association convened in the Seventy-fourth Regiment Armory, and was called to order by the President, Dr. Benjamin Lee of Philadelphia, Pennsylvania, at 10 A. M.

In accordance with the wishes of the President all ex-Presidents of the Association, present at this meeting, took seats upon the platform.

The President.—Many years ago—I cannot say how many because that would be giving away the ages of two elderly gentlemen present—many years ago, a trembling medical student stood before his examiners for graduation. He was obliged to pass seven subjects. Among those subjects I need hardly say hygiene was not included. In those days hygiene was not a part of the curriculum of any medical college. There were, however, men in the profession who felt even then that in simply attending their patients, administering pills and potions, and cutting off legs, they were not fulfilling their full duty to their profession, or to humanity. They felt that the knowledge which they acquired should be utilized for the benefit of the entire public and of the world.

Among those far-sighted men was Dr. Stephen Smith of the city of New York. He who addresses you was the trembling student. Professor Smith was his examiner. It is not necessary for me to say anything in regard to the prominent place which Dr. Smith, as the first President of this Association, and as an earnest worker in harmony with it ever since that time, has occupied in the minds of sanitarians. It is scarcely necessary for me to introduce him. I do so, however, with very great pleasure. (Applause.) (See p. 19.)

Dr. A. L. Gihon, New York City.—Mr. President, in rising to move a vote of thanks to Dr. Stephen Smith, it may be permitted me to say that the child whose birth he witnessed in 1871 has now become triplets. It has two sisters—Canada and Mexico. It so happens that sitting on my right is the Director-General of Public Health of the Dominion of Canada, one of our honored ex-Presidents, and sitting on my left is the Supreme Head of the Sanitary Department of Mexico. Our two sisters have done that which Dr. Smith thinks the United States should

do. These two men are the sanitary powers of their countries. Where is the sanitary power of the United States? Let it be the duty of this Association not to plead, not to ask, not to recommend, but to *demand* that there shall be in our country just such a system, and just such a supreme sanitary power as our two sisters have, represented in the persons of our friends and ex-Presidents (Applause.)

THE PRESIDENT.—You have heard the motion of Dr. Gihon, that a vote of thanks be extended to Professor Smith for his excellent and instructive address. What is your pleasure?

The motion was seconded and carried.

THE PRESIDENT.—The next thing on the program is the announcement by the Chairman of the Local Committee of Arrangements, Dr. Henry Reed Hopkins of Buffalo. Dr. Hopkins, as most of you know, is detained at home as the result of a serious accident. The announcements will, therefore, be made by Dr. Carey of Buffalo.

DR. CAREY.—As you have heard, owing to the accident that befell Dr. Hopkins, the announcements to be made by the Local Committee, will be undertaken by one who is much less familiar with its work. I have, however, to state, that there was to have been a reception to the members of this Association by the Buffalo Club. It was a joint reception to be extended to you gentlemen, and also Governor Odell. I also have an invitation which is extended to you, but particularly to the women who may be in attendance, and who are accompanying members of the Association, to attend an afternoon tea to be given at the Woman's Building, by the Board of Woman Managers, Pan-American Exposition, on Thursday, September 19, from 4 until 6 o'clock.

Owing to the profound mourning into which the world at large has been plunged by the terrible assassination which has occurred in our very midst, and during our gayest season, it is hardly necessary for me to announce that these entertainments have been indefinitely postponed.

Those of you who arrive late, and are not furnished with them, will find at the Treasurer's desk complimentary souvenir tickets for the Pan-American Exposition. There has also been engaged a coach to show the members of the Association the city generally, which will leave here every day, including to-day, promptly at 11 o'clock, for a two-hour trip around and about the city.

DR. HENRY D. HOLTON, Brattleboro, Vt.—The members of this Association, in common with all the citizens of our country, are under the shadow of a great sorrow in the assassination of our beloved President, and all the peoples of the civilized world are in sympathy with us,

and I move you, sir, the appointment of two members of this Association, who, in connection with the President, shall propose suitable resolutions to be presented on Thursday morning, before we adjourn for that day, in expression of our sorrow at this terrible calamity and the loss which we have sustained in the death of the President.

The motion was seconded by Dr. Montizambert.

Dr. F. Montizambert, Ottawa, Ont.—May I respectfully be allowed to say a few words. This year has witnessed two of those events which make the English speaking peoples forget any little differences that may ever have arisen between them, and remember only ties of common brotherhood. Last winter the British Empire lost its ruler, but we had at least the satisfaction of feeling that Queen Victoria had been spared to us up to and beyond that period of life at which we are warned to expect the end. The people of the United States are now passing through a similar sorrow, darkened by the shadow of crime. A wise and kindly ruler, who deserved not only the loyalty but the personal affection of all, has been stricken down in the midst of a festival devoted to the peaceful triumphs of civilization, and only a few hours after having addressed to his fellow countrymen words full of liberality and good will to all the nations of the earth.

It is in no spirit of the merely conventional courtesy due to a stricken nation in which we in Canada mourn with you. The crowds gathered around our newspaper offices, the flags at half-mast on governmental, municipal and private buildings, the memorial sermons preached, and the mourning music played in our churches last Sunday, and the bowed heads and saddened countenances of all, are amongst the evidences of our sincere and spontaneous sympathy and sorrow. Throughout Canada, believe me, there is but one sentiment of grief at what we feel to be our common loss in this great and good man. There is but one sentiment of deep and heartfelt sympathy with this nation, and with that noble and afflicted lady herself who but so recently escaped from the grasp of death, who is now thus cruelly smitten.

Dr. E. Licéaga, Mexico, Mex.—(Interpreted by Dr. A. L. Gihon.) I desire, in the first place, to thank the Association for having taken me into its membership, and to call attention to the fact that when I was last in Buffalo it was as President of this Association, and I was received with joy and gladness everywhere, as contrasted with the solemn occasion of the present meeting, when Mexico, like all the rest of the world, mourns with you at the horrible deed which was not directed personally at Mr. McKinley, not directed personally against the President of the United States, but directed against authority, universal

authority, the rights of men, the principle of supreme direction. I wish you to feel that Mexico is with you in the deepest depth of sorrow which you are now experiencing.

It was moved and seconded that the names of Dr. Montizambert and Dr. Licéaga be added to the committee of two, with the President, to be appointed on the motion of Dr. Holton. Carried.

THE PRESIDENT.—The motion of Dr. Holton, so feelingly seconded by the representatives of the Dominion of Canada and the Republic of Mexico, that a committee of two be appointed, together with the President, and with the representatives of Canada and Mexico, to draft resolutions expressive of the sense of profound sorrow entertained by this Association in reference to the death of our beloved President, is now before you. All in favor of the motion say, "Aye."

The motion was carried unanimously.

THE PRESIDENT.—The Chair will appoint Dr. Holton, Dr. Bailey, Dr. Montizambert and Dr. Licéaga as members of that committee.

The next business is the report of the Executive Committee by Dr. Charles O. Probst, Secretary of the State Board of Health of Ohio and Secretary of this Association.

THE SECRETARY.—The Executive Committee held its first session at 10 A. M. yesterday. A number of applications for membership were examined and are now reported with the recommendation that they be elected. Their election will be the next order of business.

It was the sense of the committee, as expressed by several members, that all public entertainments be abandoned out of respect to the late President McKinley; and the Executive Committee decided to hold nothing but a business meeting on Thursday next, the Advisory Council to hold its meeting on September 18. (The list of applicants was read.)

DR. SAMUEL H. DURGIN.—I move that the Secretary be authorized to cast the ballot of the Association for the election of the members named. Seconded and carried.

The Secretary then cast the ballot of the Association, as instructed, and the applicants were declared duly elected.

DR. CHARLES A. LINDSLEY, New Haven, Conn.—If it is in order, I would like to offer a resolution to be referred to the Executive Committee, as follows:

"That this body deplores the action of Congress in curtailing the operation of the army canteen or post exchange, and in the interests of general and military sanitation recommends its establishment, on its former basis, at the earliest possible date."

The motion was seconded by Dr. Stanton. Carried.

THE PRESIDENT.—The next business is the reading of the minutes of the last meeting.

DR. DURGIN.—I move that the reading of the minutes of the last meeting be omitted, but approved as printed in the last volume. Carried.

Dr. Peter Bryce of Toronto read the "Report of the Committee on Animal Diseases and Animal Food," in the absence of Dr. D. V. Salmon, the Chairman of the committee. (See page 45.)

THE PRESIDENT.—The next is the "Report of the Committee on Transportation of Diseased Tissue by Mail," by F. F. Wesbrook, Chairman, Minneapolis, Minnesota. (See page 27.)

In view of the fact that the program has two or three other papers on this subject of tuberculosis, I would suggest that the discussion of the report be delayed until the reading of these other papers, and that the discussion on Tuberculosis become a general one.

DR. GIHON.—I move that the suggestion of the President be adopted. Seconded and carried.

Dr. H. M. Bracken, Secretary State Board of Health, St. Paul, Minneapolis, read the "Report of the Committee on National Leper Homes," he being Chairman of the committee. (See page 34.)

DR. H. M. BRACKEN.—The committee to report on National Leper Homes has done but very little during the past year. The matter is under consideration by a commission appointed by the Government from the Marine Hospital Service and it seemed well to wait until the report from this commission was given to the public. I believe this report is well along now, and it may be expected soon. The report of the committee is given you in print, but it is not necessary to read that, but simply to state that the feeling of the committee is still in favor of establishing National Homes for Lepers, and that there should be established in the United States at least two, one for the Northern climate and one for the Southern climate. There is no reference made to these national homes in either Canada or Mexico. Both of those Governments are provided with such homes at the present time. It is only to urge upon the Association the necessity of favoring the creation of such homes in the United States, and I trust something further can be reported at the next annual meeting.

THE PRESIDENT.—This closes the morning meeting. We have, however, a good deal of time left. The Chair will entertain a motion that we proceed with the papers provided for the afternoon session.

It was moved and seconded that the Association proceed with the program of the afternoon. Carried.

THE PRESIDENT.—The next paper is by Dr. Chico, but as he is not present the Chair will call upon Dr. Formento to read his paper on "Tuberculosis."

Dr. Felix Formento of New Orleans, Louisiana, then read his paper on "Tuberculosis." (See page 81.)

Dr. Jésus Chico of Jalisco, Mexico, then read his paper entitled "Observations Intended to Prove that the Meat and Internal Organs of Tuberculous Animals Bring About the Appearance of Tuberculosis in the Persons Who Eat Them." (See page 78.)

DR. L. H. MONTGOMERY, Chicago, Ill.—This morning the name of our late President, Dr. Henry B. Horlbeck, was omitted. It is with diffidence I rise to make a motion. I desire to move that a committee of three be appointed to present suitable resolutions respecting his death and report to-morrow morning, or upon Thursday morning. If I may be pardoned for the suggestion, the committee to be composed of three ex-Presidents of the Association.

THE PRESIDENT.—This motion will go to the Executive Committee.

On motion, an adjournment was then taken until 3 P. M.

FIRST DAY—AFTERNOON SESSION.

The Association re-assembled at 3 P. M., and was called to order by the President.

THE PRESIDENT.—The Chair understands that Dr. Montizambert was present at the Congress on Tuberculosis, held during the last summer in England, and before the general discussion on the subject of Tuberculosis is commenced, it would be interesting to hear from Dr. Montizambert some report of what was done.

Dr. F. Montizambert of Ottawa, Ontario, then read a report on the recent British Congress on Tuberculosis. (See page 35.)

DISCUSSION OF THE PAPERS ON TUBERCULOSIS.

DR. E. A. DE SCHWEINITZ, Washington, D. C.—I think that Dr. Salmon has reviewed the subject so thoroughly in the report which he has presented, and the other papers which have been read have covered the ground so well, that there is scarcely anything of interest that I could add.

There is one point in connection with tuberculin which I think is of interest, and one to which possibly a good many do not pay sufficient

attention, and that is that tuberculin—a solution of the product of the tuberculosis germs—will produce characteristic reaction in tubercular cattle as well as in man, and can be made from the human germ which is perfectly innocuous when injected into an animal. I would be perfectly willing myself, and perfectly willing to take the responsibility of injecting into some one 10 or 15 c.c. of the culture of the tuberculosis germ, which I have used for many years, and I would be satisfied that the person who received the injection would not contract tuberculosis. Still the tuberculin made from that germ will produce just as good a reaction as if the germ were thoroughly virulent. Those germs are the descendants of germs that were particularly virulent. I have had the same germs in my laboratory. When they first came into our hands from Dr. Trudeau, they would kill a guinea pig within about three weeks. Now, it is utterly impossible, or has been up to the present time, to produce the slightest sign of tuberculosis in a guinea pig with 10, 15 or 20 c.c. of the same germ, although its products cause a characteristic reaction just as before. The tuberculin which is made from the bovine tubercular germ does not give any more characteristic reaction than the tuberculin which is made from the human germ. The principal reason that the human germ has usually been used rather than the bovine germ is because the human germ can be more readily cultivated on artificial media, while the bovine germ can be adapted to artificial growth and made to grow readily, it will not grow nearly as rapidly as the human germ.

Dr. Peter Bryce, Toronto, Ont.—It becomes a very delicate matter for any of us, although we have been working at and discussing this question of tuberculosis as health officers for fifteen or twenty years, to risk any reputation we may have for judgment or common sense in even suggesting a difference of opinion from that expressed by so great a man as Professor Koch, and yet one can not feel that we are for a moment to let the matter rest in its present condition. Nearly every one has, I think, seen, if he has charge of the mortality statistics of his Province or State, that tuberculosis is increasing, or at any rate not decreasing, in mortality. He likewise recognizes the fact that owing to our municipal insufficiencies, the lack of consecutiveness in municipal government and the lack of sufficient legislation in the matter of governing milk supplies of our cities, we are constantly facing an increase of tuberculosis in children; and not only that but we are face to face with the danger present at all times of the transmission of such diseases as scarlet fever, diphtheria and typhoid fever, and human tuberculosis through impure milk. That being the case it is necessary for sanitarians to take up the whole question of the condition of our daily dairy sup-

plies, the condition of our cattle, and the condition of the people who handle those cattle as regards the production and transmission of milk to our children. If this be true, it occurs to me, whether we prove this year or next year or a hundred years from now, that the tubercular germ cannot be transmitted from cattle to man, that it does not lessen the important question of the need of inspection as regards tuberculous cattle, because that very act of inspecting dairy cattle leads us to inspect a dozen other practical conditions bearing on the lives and welfare of our community. We are many of us in the position of public officers whose work depends upon the favor with which we are received by the people, because after all the government will give us money in proportion to the confidence they have in the work done by us.

We have been saying, some of us, for a number of years, that the transmission of tuberculosis from animl to animal, and the destruction of whole herds in many cases in order to stamp out tuberculosis, not from the human standpoint but for the maintenance of a herd, is the reason why the cattle should be examined almost daily, certainly periodically, with the view of eliminating the disease in any animal and in any stable. All of us know that there has been put into our hands, as Dr. de Schweinitz has said, by Professor Koch, tuberculin, by which we can go through a herd and pick out with almost unerring certainty all cattle that are diseased, or beginning to be diseased with this fatal malady. Shall we for the moment drop the question and become indifferent to it because we are told that it is not going to affect the lives of our children? We cannot do that as practical men. We are dealing with the question from the standpoint of economics, and we shall continue to deal with tuberculosis as an economic question. It is necesssary to stamp it out in order that the cattle may not only go to the market strong and wholesome, but that the actual financial income will not be decreased by a disease which has caused in other countries 34 per cent. of the mortality, while in our country we are told that it is only 2 or 3 per cent. at present.

There is one other point, and I wish with all deference to our bacteriologists and Dr. Koch, to point it out, as a question which it is their duty to teach us more about; namely, the natural life history of germs as determining their variations under environment. I have had occasion to study the question of vaccination this last two or three years very thoroughly, and bearing upon this point I wish to recall one fact. I think all bacteriologists tell us to-day that immunization is specific in the sense that to immunize an animal against one disease is not to immunize it against several diseases; and yet we have the one immunizing substance, vaccine lymph, which does immunize a cow against vaccinia. We have the same germ immunizing human persons against

smallpox. The struggle between those who say the two diseases are one has been going on for one hundred years, because they have taken the smallpox germ and transmitted it with difficulty through several cows until we have the germ produce normal vaccinia in man or animals, and it remains a germ at that stage without any notable variation. If that is true, and I believe it to be true, can there be any logical reason for saying that the germs of tuberculous cows taken into the human system with milk will not lie as saprophytes on the mucous membrane, passing through one generation to another, changing in their environments, as we know the pneumococcus and other germs do, until some abrasion of the surface takes place and the modified germ finds easy access into the tissues of the human body and thus produce the actual tuberculosis of man? Clnical as well as bacteriological experience has shown us that modification is constantly going on in these germs. May we not assume that the same conditions which cause to develop the tubercular germ in the cow at 101° temperature will have the ability to attack the human being whose temperature may reach 101°? I feel quite certain that none of us here, as sanitarians, will drop for a single moment their activity against the dangers which come to us from non-inspected cattle and tuberculous milk.

Prof. Wm. H. Brewer, New Haven, Conn.—The two last speakers have suggested a point, it seems to me, of importance, along the line of desirable future investigation. Dr. de Schweinitz stated at the beginning that the culture of the bacilli still used by the Department of Agriculture for the production of tuberculin for the diagnosis of tuberculosis in cattle, is kept up from cultures which have been extended for six years; that originally these bacilli showed their pathogenic virulence by easily producing tuberculosis in guinea pigs, while to-day they do not produce tuberculosis without great difficulty. Now, it seems to me that the interesting point is here, that we have a change going on in the species, the physiological processes or anatomical structure, if a bacillus can have any anatomy, while its chemical products may remain essentially the same, yet are weakened or modified. Our knowledge of the chemical products produced by bacteria is exceedingly meager compared with their importance. I believe it is generally thought, that, in many cases at least, the fatal results are due to the chemical products produced rather than to any mechanical cause. For example, you recollect that twenty years ago when discussing the subject "How Does Anthrax Kill an Animal?" mechanical obstruction was alleged. Photographs were used to show that the capillaries were filled with and clogged by the bacilli. We now believe that, in many diseases, at least, the killing comes from the chemical product pro-

duced by the bacteria. Now, to-day, it seems probable, so far as the case of many diseases are concerned, that we may have bacteria in great numbers, so far as their mechanical presence is concerned, without damage. It is the chemical product of their growth that causes the trouble. Although our bacteriologists study bacteria partly from the chemical side, I think that this part of the question needs more and more attention. It has received some, but not enough, and it seems to me that here we have an intensely interesting case illustrating that we may have, in these exceedingly low orders of vegetation varieties, which are analagous to the horticultural varieties of plants in the garden, and where we have enormously different outward characteristics but where the chemical products remain essentially the same. We have prussic acid in the peach, whether the fruit is small or large, or what the color of the fruit may be. So with the melon, through its various sizes and colors, any one would recognize it from its flavor, which depends upon its chemical composition. It seems to me that here is a line of investigation that should be continued much farther, and, in the second place it tends to throw another shadow of doubt over Dr. Koch's recent conclusions. It illustrates that we may have a new variety of bacillus produced by cultivation (or by natural processes in the cow,) in which in the plant acts a little differently in the way in which it grows but that when it does grow, it produces the same thing chemically, yet different in degree of virulence. This is an exceedingly interesting point. If I recollect aright, the newspaper stated that he exhibited the four-hundredth (or more) cultivation of the original tubercular bacillus, from which his original papers were published, and it is very possible that he may be experimenting on his cattle with these cultivated bacilli, which have been so long in cultivation that they will no longer grow in the old soil, although they are still, chemically and botanically, the same old bacilli of tuberculosis. It seems to me, that he may thus be using a new "gardener's variety" of the same old bacillus.

THE PRESIDENT.—It strikes me that we should hear from some member of the section on bacteriology.

DR. A. C. ABBOTT, Philadelphia, Pa.—I have listened with very great interest to what has been said and have purposely refrained from speaking on the subject for two reasons: first for lack of convincing data on the topic under discussion; and second, because I am obliged to differ very directly with the last speaker in the position that he has taken. During the last few years the work of the modern bacteriologist has been conspicuous for the emphasis that has been laid upon the chemical side of the problem. The question of variation to which the

speaker refers is one that has received no small degree of attention, and we now know that variation may occur in living bacteria both spontaneously and as the result of artificial treatment. The most striking example of this latter condition we see in the vaccines that have been put to such practical use. As our knowledge on this subject has increased we have discovered that bacteria produce disease not by their mechanical presence in the tissues but by poisons that accompany their growth in the tissues, and it has been possible by appropriate methods to isolate these poisons from the bacteria by which they were produced and through the use of these poisons to produce conditions to all intents and purposes identical with those resulting from the activity of the living bacteria. It is of equal interest to know that the toxicity of these poisons may be easily modified by particular methods of treatment, just as in the case of the living organisms. An illustration of spontaneous variation in the presumably lifeless toxins of bacteria is seen in the singular degeneration of diphtheria toxin to which Ehrlich has long ago called attention; a degeneration that is less readily discovered through its test-tube reaction than after injection into the living body of susceptible animals.

It is scarcely appropriate at this time to enter into details on these questions, so I shall pursue them no farther. The subject is at this time one of considerable complexity, and the problem of the bacteriologist of to-day is altogether a different one from that of the days when he regarded his task as that of simply isolating particular species from mixtures of species by the ordinary technical methods pursued in bacteriological laboratories. Indeed in many respects we have got ourselves into pretty deep water, and it seems likely that the solution of many of the recent observations are only to be reached through the study of the subject from the chemical and physical standpoint.

I am aware that what I have said has no bearing upon the subject set for debate this afternoon, but the remarks of the last speaker were of such a nature as to be a little misleading, and I felt called upon in justice to the bacteriologist of the day to set the matter straight.

Dr. John C. Shrader, Iowa City, Iowa.—We as sanitarians occupy a very important position in the world of education to-day. The great mass of the people are looking to us and to those who devote their lives to the relief of suffering, and they are ready and willing to spend their money to pay men for their time, to a certain extent, to visit and attend these meetings, let them be held where they will, in order that information may be gained for their benefit. We know that much has been accomplished in the last ten, fifteen or twenty years in the way of prevention of disease—we may say nearly all of the infectious diseases.

We know better how to treat them, and how to instruct the people that they may have less suffering, and their lives may be prolonged. These great meetings, this being one of them, and the one of which we had such an excellent report by Mr. Montizambert, that was held in London in July, are simply the outgrowth of this sentiment on the part of the people to learn all that can be learned in regard to the treatment and prevention of these diseases. These premises being true, as I understand them, it behooves each and every one of us to be careful that no sensational documents are published or sensational statements made. Let the principles that we enunciate be reduced until we are certain by the cold facts of science that what we are saying is true, and will stand the test, and that it is the best thing that can be done to correct, control and prevent this class of diseases that we call infectious, or in other words, the control of preventable diseases, and when we say "control of preventable diseases" we have included nearly all the diseases with which we are suffering to-day in this category. We know they are preventable. They should not exist. The people wish to be advised, and to know what it is best to do to prevent becoming sick, and that their children may grow to be better and stronger than they have been.

Much has been said in regard to the proceedings of this great Congress in London at which I had the pleasure to be present, and to be a listener to the papers that were read. Much information was gained upon this subject, no doubt, but much remains to be done. Perhaps, while we don't agree, all of us, with what a great light on tuberculosis has said, Professor Koch, still, perhaps what he did say may result in great good for the very reason that we will continue to investigate this subject more thoroughly than we would have done if he had not given such startling statements to the world. Therefore, let us continue the investigation of this great subject before us—one that is engrossing the attention of the world to-day more than any other; I was going to say, more than all others, but more than any other one subject, and we hope and believe that if this investigation continues that the time is not far distant when we will be able to say to the people: You can escape this great scourge. Therefore let us continue this investigation thoroughly, and because someone throws out something that we don't believe let us reduce all these things to strict and thorough investigation, and great good will be the outgrowth therefrom.

Dr. W. C. Chapman, Toledo, Ohio.—A paper read this morning by Dr. Formento of New Orleans, interested me as a practitioner of medicine, more so perhaps than if I had been engaged in laboratory work.

I think that some of us are too strongly urging that tuberculosis is a non-hereditary disease. Are we not leading the public astray in our

use of the term "non-hereditary?" We are teaching that any one may contract the disease without hereditary taint, if placed in an environment charged with the infection. This teaching is undoubtedly correct, but there is an hereditary defect that renders persons more susceptible to the infection if born of unhealthy parentage. I believe there is a tendency in every one who comes from tuberculous ancestry to readily develop the disease; the germ may be carried to others, but if the soil is prepared for its development by hereditary predisposition, then will tuberculosis appear and go on to a fatal termination more certainly. I believe consumption is produced by the bacillus tuberculosis, but in order that it may develop, environment must be such as to permit of its growth.

As sanitarians we should begin with the children, train them so that hereditary predisposition may be overcome and then if exposure to the poison occurs such exposure may be rendered inoperative by strength of resistance.

Dr. J. I. Gibson, Denison, Iowa.—As one engaged in practical sanitary work this is probably the question of greatest importance to me. I have been dubbed a ruthless destroyer of cattle, and in the face of Professor Koch's statements, I am not becoming any better looking in the eyes of some of my people; but I am not prepared to accept the statement. It seems to me in my short experience in practical field sanitation that I have seen enough to satisfy me that human and bovine tuberculosis are identical, or virtually so, and are intertransmissible. I might cite a number of instances that are very conclusive. How bacteriology views this subject might be called the theoretical side; the field of experience is the practical side of it. When anything will work in practice it beats theory all to pieces. If theory and practice are unanimous you can have no better evidence. Now the question is: What is right? What is the right thing for me to do? I attend the meetings of this Association, sometimes as a delegate and sometimes as an individual interested in the subjects discussed here. I tell all my people, and all the people I come in contact with, that this is to me the greatest sanitary body that meets in America, and that there is none greater. Now what will this body do with regard to this question.

The Iowa State Board of Health recently issued a circular on the subject of Tuberculosis. Now, we feel that it becomes necessary for us to follow that with a supporting circular or some kind of a circular of denial, and I think I represent the feelings of our State Board of Health when I say that they would be guided to a great extent by the action of this Association. Now, I would like to see the question put either in the affirmative or negative form to the gentlemen and the ladies of this

Association by a vote or a roll call to see where we stand, and to see whether or not we dare kill any tuberculous cow. Now, for myself I say I conscientiously believe the disease is transmissible from the bovine to the human, and I believe it strongly enough that I would not have anything else but a tuberculin tested cow to furnish milk for my family. I don't know how many sanitarians present are practical enough in their sanitation to see to these things, but I know that I won't have anything else but the product I am sure of. Such an Association as this should have a code of ethics to live by, and if each gentleman here, and I see a number of very influential gentlemen before me, would adopt such a code in his home living, practical sanitation would spread through the whole country. I think we should be practical sanitarians, and deal with this matter in a practical way. I need this help, and there are probably others here who also need it.

Dr. Samuel H. Durgin, Boston, Mass.—We find there are two classes of consumptives to be educated. There are those who would benefit by a circular as to what the person should do who is afflicted with tuberculosis, those who will learn how to take care of themselves and not transfer the disease to others. There is another class who pay no attention whatever to the circulars, and instructions which may be given them. I do not believe that active patients should be quarantined so long as they heed the advice given. There is a class of patients who need to be picked up and carried to the hospital, for proper care and for public protection. This class we take, if necessary, by force, just as we would take a case of smallpox, and confine it so long as we think the confinement necessary. Occasionally a patient will recover, or possibly the family may become able to take such care as would be necessary to stop the spread of the disease. In that case we liberate the patient. With regard to the milk, we require that the herds be examined by veterinarians, and if there is tuberculosis among the cows of any farm that milk must be stopped at once. On notification, the milk is stopped, the herd examined, the premises cleaned up, the diseased cows killed, and when everything has been done satisfactorily to the Board of Health the milk of such farm may resume its entrance into the city.

I mention this to show what we are doing in a practical way in our city, and I would be very glad to know what the practice may be in other places. The matter of placing consumption in the list of infectious diseases, and taking patients by force to and holding them in the hospital, is something I haven't known others to do, and yet I cannot see any reason why we shouldn't treat helpless and careless ones precisely as we would treat a case of smallpox.

PROFESSOR BREWER.—In case of the destruction of cattle, who pays for the cattle?

DR. DURGIN. I am not sufficiently familiar to say authoritatively, but I think when the fact is proven that it is tuberculosis, that the State pays a portion or all of the value of the animal.

DR. WM. FAWCETT SMITH, San Juan, P. R.—I represent Porto Rico, which eventually hopes to become one of the stars in the American flag. While hardly justified in speaking before this meeting, still I think Porto Rico is entitled to have her opinions, incomplete as they are, presented to you.

As touching the immediate subject of discussion, I wish to say this, that in our country I have yet to find one cultivated man who has taken the slightest stock in Dr. Koch of Berlin, great as his authority may be. The Superior Board of Health of Porto Rico utterly disbelieves in the doctrine, and has taken the most active means possible to cripple the disease of tuberculosis in cattle. Mr. Allen, who to our great regret has left us, but who has left a most able successor, has very kindly placed at my disposal a small appropriation to employ expert veterinarians, to inspect cattle brought into San Juan and other markets. We have already established a tolerably complete system of inspection greatly against the wishes and with great opposition on the part of some of the cattle dealers. The result has been very marked during the few weeks which this plan has been in operation. In the course of a very short time I hope to have a system of meat inspection in connection with other towns of importance on the island. As to making a complete meat inspection, that is a difficult question. If there was opportunity to explain the difficulties you would see at once how impossible it is to reach all the districts, and have expert veterinary inspection. We can hope to have at present only a fair inspection in the large cities.

As a practicing physician, as well as sanitarian, I could give you scores of instances to conclusively prove the transmissibility of bovine tuberculosis to man, and I am sure that all of my colleagues in Porto Rico will bear me out in saying that in our minds the question does not admit of argument.

I thought it would be of interest to the Association to know that our little spot of Porto Rico is earnestly striving towards the ideal which an Association of this kind sets before us.

DR. C. A. LINDSLEY, New Haven, Conn.—I would like to inquire what percentage of cattle that have been tested has been found to be tuberculous?

DR. W. F. SMITH.—I have only very limited statistics to give you.

Dr. C. A. Lindsley.—I would like to ask if tuberculosis is very frequent?

Dr. W. F. Smith.—Very common.

Dr. Lindsley.—Pulmonary or intestinal?

Dr. Smith.—Pulmonary, and intestinal is common also.

Dr. Lindsley.—Do you consider pulmonary tuberculosis to be derived from the use of infected milk?

Dr. Smith.—I am not prepared to state the exact proportion, but in my own experience I could mention several cases of pulmonary tuberculosis.

Dr. Lindsley.—You think pulmonary tuberculosis results from infected food?

Dr. Smith.—Principally milk. I express the opinion of the majority of medical men of the island.

Dr. Lindsley.—I believe we are accustomed to adopt that belief from theory rather than from actual and careful observation. It would be the natural inference that if we partook of infected food we would be liable to the disease which that infection produces, and if it can be shown that milk and beef contain the tuberculous bacilli, it would be the reasonable inference that the human subject would suffer from the same disease. I have only one fact that bears upon this question. For the last three years I have been accustomed to issue to the Health Officers of the State of Connecticut a series of questions relating to sanitary matters, and among them is this: Have there occurred under your observation any well authenticated cases of tuberculosis which you have believed to result from the use of infected milk or beef, and if so, what are the evidences upon which you base your belief? I haven't received one single answer from any health officer in our State in three years, but at the same time I think the great majority of them would express the same opinion as the gentleman from Porto Rico. They cannot give a single instance, or haven't, in which they could give reasons for thinking that tuberculosis is produced in that way. I cannot conceive easily how it would be possible for tuberculosis in the lungs to be produced by the use of food unless it first appeared as the intestinal form.

There is another matter which was suggested by the gentleman from Porto Rico. If I understood him correctly tuberculosis is increasing. In New England it has decreased very positively and markedly in the last ten or twenty years—in Massachusetts, Rhode Island and Connecticut, and the testimony from England is that it has diminished

there in a large degree. I rather think that throughout the civilized world tuberculosis is diminishing.

Dr. J. I. Gibson, Denison, Iowa.—Have you any argument, or any proof to offer showing that a case of pulmonary tuberculosis is due to pulmonary infection?

Dr. Lindsley.—Nothing more than theoretical, but if the infection is floating in the atmosphere it may be inhaled in the lungs, and if there is a lesion in the air passages it is the natural inference that those tissues would be affected first. There is a theory that all infected tuberculous patients receive the infection from the stomach, but it does not seem to me to be reasonable.

Dr. J. I. Gibson.—I would like to state one case of infection in connection with a family cow in a county seat town in the State of Iowa. This family cow was presented to an assistant of mine in State work. She was found to be coughing, some fever, but in a plethoric condition, and a good looking cow. He advised a tuberculin test, but the owner did not believe it was necessary. Eight months later he was called again, when he found this cow still coughing, with a hectic fever, and very much emaciated. The owner then submitted to a test, and upon a reaction of only a degree and a half, consented to the destruction of the cow. She was found to be affected with tuberculosis of the lungs, intestines and udder. That is now nearly four years ago. This cow's milk went into three families in that town, and during those years three persons have died, and three more have been infected, one a man of fifty years of age. This man had tuberculosis of the intestines, also said to have had tuberculosis of the stomach, which I believe is very rare; a lady had tuberculosis of the lungs, and a young man had tubercular meningitis, while three others were infected. We have other instances almost as strong, but this is probably the greatest argument we have from one cow. Substantiating the theory of the transmission of bovine tuberculosis to the human through the use of milk. Here are three families supplied with this cow's milk, persons affected in all three, and only one person whose family would account for his having tuberculosis.

The President.—The authors of the several papers have the right to speak in closing the discussion.

Dr. John B. Learned, Northampton, Mass.—If it is proper to speak upon any other influence leading up to tuberculosis than bovine tuberculosis I would occupy a moment in that direction. It is my judgment and has been for many years, that we lay the foundations of tuberculosis in infancy, in the nursery, in the sleeping room, and in the

school houses to a far greater extent than it is possible to through any defects of our stock in the stable, however great this may be. I deplore the methods whereby we bring the young animal to milk, giving it two years for development, and sometimes less, and then hurrying on the milk product with the concentrated foods for the benefit of the bank account, without regard to the life of the animal, until that animal is charged with tuberculosis from beginning to end. It is not milk and meat alone that cause tuberculosis in the boy or girl, or young man or woman. The absence of vitality on the part of the young man or the young woman is what renders that person subject to any and all diseases. The presence of vitality and perfection in growth and development is what arms us for the conflict in life. The average sleeping room, so far as I know, in New England, where I have practiced medicine, is not large enough to furnish air for one person from the hour of retiring to the middle of the night; when frequently there is the father and mother and two or three children. The average air of the school room is short of oxygen long before the noon hour, for teacher alone, to say nothing about the twenty, thirty, and sometimes fifty students that are there. The general atmosphere in our audience rooms, in the church and theater is charged with noxious gases, and even in the halls where medical men are congregated, is so limited and polluted that I think sometimes medical men ought to feel chagrined at going out and talking to the public about our special measures for defeating the enemy, the tubercular bacilli, when we ourselves have been doing everything to encourage, as it seems to me, the development of the bacilli. I remember, on one occasion, a large audience coming together, which filled the hall, and not a window or door was open, but simply a small ventilator overhead. There we listened for an hour and a half or two hours to a very long and able paper by a distinguished gentleman upon the cause and prevention of tuberculosis; and we were breathing an atmosphere that would contribute in every possible way to the development of tuberculosis. I don't want to step upon any measure that promises any good, but I do want to say that we must improve all our home methods and our general health measures, and we must promote the vitality of our boys and girls. Outdoor life will do it. Give the boy a chance to come up to six feet in height and weigh two hundred pounds. There is no need of the boys being crowded through any of our colleges and weighing only one hundred and twenty-five or one hundred and thirty pounds at graduation. The little bulge of gray matter that he gets in consequence of early training is no excuse for his coming out and going straight into the hands of the medical man.

Dr. Eliza M. Mosher, Ann Arbor, Mich.—If it is in order to speak upon other influences than those of tubercular cattle, I want to say a word in connection with the remarks of the last speaker. I would like to refer to the bad habit of postures of school children which are permitted, and which in my opinion have much to do with laying the foundation of tuberculosis. First, sitting in school with the hollowed chest; second, stamping on one foot, usually the right, shortening the ribs and bending the spine to the ribs, shortening space between head and shoulder and permitting one side to rise in inspiration and the other to remain quiescent; increasing the tide of air on one side and lessening the tide of air on the other, due to posture. I see no reason why a badly ventilated lung from a bad posture is not just as bad as a badly ventilated lung from impure air. How many cellarless houses are there in the United States? I think we all agree that there should be a dry cellar, well separated from the ground outside, the air of the ground and the water of the ground. Between the town of Ypsilanti, Michigan and the city of Detroit, I counted one day one hundred and fifty-five houses without cellars and without ventilation beneath the houses. Michigan is full of tuberculosis. Unventilated chests, unventilated houses and cellarless houses are possible causes of tuberculosis in this country. We all know that in that wonderful country, Norway, which ought to be so free from disease, and especially from tuberculosis, with its strong bracing air—we all know that tuberculosis is the common disease which carries off multitudes of people there as here. We all know that the people all through the country of Norway live in absolutely unventilated houses. The smell of the very room is that of air which has been breathed over and over again, and there are no cellars and often no ventilated space. Now, it seems to me that this Association can not afford to spend all its time over the possible or probable production of tuberculosis from the use of milk and meat. It seems to me that we must also put ourselves on record as against all of those other things.

The President.—This discussion is of great interest, but the Chair feels that in justice to those who have papers to present we can not continue it longer. The Chair has already called upon authors of papers. Are there any of them who desire very briefly to speak? If not, we will proceed with the further business of the Association. The Chair will request, however, to be allowed to make a statement.

He feels that he voices the sentiment of the Association in extending a hearty welcome to the delegate from Porto Rico. It is the first opportunity that we have had to welcome a delegate from our little sister, and it is certainly an occasion of much interest. The Chair

desires to state in this connection that, owing to unavoidable complications, it was a matter of impossibility to provide such a program for to-day as would fully occupy our time. This is the case with regard to the evening session, and it has been deemed wise, therefore, to make provision for the reading at the evening session of reports from representatives of the Island of Porto Rico and the Philippine Islands. The intention is that these papers shall follow the delivery of the President's address this evening.

The Executive Committee has had presented to it a paper on "Vaccinal Immunization from the Health Officer's Standpoint." This, as the Chair understands it, is from the pen of Professor Bryce of Toronto, and the Chair will therefore call upon Dr. Bryce to read it.

Dr. Peter H. Bryce of Toronto then read his paper on "Vaccinal Immunization from the Health Officer's Standpoint." (See page 175.)

Dr. Wyatt Johnston of Montreal, P. Q., followed with the "Report of the Committee on Teaching of Hygiene and Granting of Diploma of Doctor of Public Health." (See page 87.)

Dr. Wyatt Johnston, Montreal, P. Q.—In addition to the report of the committee, we have special reports upon certain branches of the matter of hygiene and education with reference to special courses of instruction recommended for universities, veterinary colleges, architects, engineers and bacteriological institutes, so that we would ask, if possible, that those reports, which are not long, be published in connection with the general report. The general conclusions which we have arrived at are stated in the report, and I need not go into that here. I would mention that the committee thinks it would be well that work along these lines should be continued for another year, and that an effort be made to obtain the views of teachers of hygiene in reference to this, and to get a good attendance at the next meeting. With reference to the individual teaching in universities, Professor Abbott could summarize in a few minutes the statements made in his report.

Dr. A. C. Abbott, Philadelphia, Pa.—Dealing with university work, I have endeavored in the report to show what has been done elsewhere, especially in the English, Scotch and Irish universities, and some of the requirements of Germany also. I have taken from the English schools what I regarded as the best course, and have suggested a composite course suitable in this country. Then, in a way, I have gone over the facilities which exist in this country. I will not read in detail my report, but have suggested what might be regarded as a fairly uniform and reasonable course of study.

The following resolution was presented to the Association by Dr. L. H. Montgomery, Chicago, Illinois, and referred to the Executive Committee:

"*Resolved*, That further practical experimentation is necessary before this Association is willing to accept the statement of Professor Koch in his paper read before the British International Congress on Tuberculosis, but puts itself on record as being in harmony with the beliefs and views advanced by that eminent scientist regarding the non-communicability of tuberculosis from the bovine to the human subject."

Dr. Jésus Chico of Guanajuato, Mexico, then read the paper prepared by Dr. Francisco Bernaldez of Mexico, Mexico., entitled: "Remarks Intended to Show the Character of Human Vaccine as a Preventive of Smallpox." (See page 182.)

DISCUSSION OF PAPERS OF DR. BRYCE AND DR. BERNALDEZ.

Dr. Eduardo Licéaga, Mexico, Mex. (translated by Dr. Formento.)—In Mexico for one hundred years there have been but five persons in charge of the vaccine distributed in the whole republic. Since 1804 only five persons have been charged with the vaccination and distribution of vaccine to the different parts of the country. We are in favor of human vaccination as against animal vaccination. There is a special board that has charge of the vaccine. They vaccinate in infancy and from arm to arm, and from child to child, being careful not to inoculate anything but the serum—not the pus or blood. By this means we have had no communication of any other disease. We have eight vaccinators for the public at large, and three who go from house to house to vaccinate. For the outside districts of the city there are six vaccinators. Our results have been excellent, and I do not believe in the necessity of re-vaccination. The best proof of this is that re-vaccination seldom takes, and there is not an example in Mexico where physicians who have been vaccinated in their infancy, and who have treated many cases of smallpox, have contracted the disease.

Dr. Felix Formento, New Orleans, La.—I will say that the ideas of Dr. Licéaga are the ideas that prevail now in most countries of Europe. Children are vaccinated from arm to arm. In New Orleans that is what we have been doing until a few years ago and I have never seen a successful typical vaccination in a person who had been vaccinated in its infancy, in this way.

Dr. Samuel H. Durgin, Boston, Mass.—I have been very greatly impressed with the reported results of vaccination with humanized lymph in the Republic of Mexico. In the last two or three years I have been obliged to consider whether or not this reported condition of things in the Republic of Mexico, in contrast with the numerous cases of small-

pox occurring in the United States and Canada after vaccination with bovine lymph, does not call for an investigation such as may bring to us the facts as to the different immunizing power of the humanized and bovine lymph. It is a fact in our section of the country that cases of smallpox are constantly appearing with numerous vaccine marks upon the arm. Whether this is due to the fact that the lymph having passed for fifty or more years through the heifer has become weakened and has lost some of its immunizing power, or whether it is due altogether to the want of care and to the insufficient number of insertions. I tell my students that I do not believe in one puncture. I believe that not less than three punctures for the primary vaccination and two for the re-vaccination are doing more and better service than the one puncture. I think it is time for this Association to appoint a committee to take up this subject and see if we can learn the facts as to the difference in power of immunization between bovine and humanized lymph.

Dr. W. F. Elgin, Philadelphia, Pa.—Perhaps it may not be amiss to give just a few words along this line, my life having been largely spent in the production of bovine virus. I came to this Association with the expectation of learning. In common with all other producers of vaccine I want to follow any deductions or anything that may be said here authoritatively that will help you and help us. Some five years ago vaccine was produced according to the system which Bernard used. Previous to that time I had inoculated calves and in twenty-four hours I have seen a discharge running down from the animal to the floor. That was prior to the time vaccination was under bacteriological control. I have every reason to believe now, in the light of present experience, that we had a very active lymph indeed, but not active in its protective properties. The point I want to draw your attention to is this, that the vaccination produced need not necessarily be protective of smallpox. The point arises, are you sure that your patients have been vaccinated at all? I am satisfied that hundreds and thousands and millions of points I sent out were not active in smallpox but active in something else. Another phase of the case is this: In my experience in the production of vaccine virus I have found it almost universally the case that the person handling the virus for the first time will become infected on the fingers. I have seen that same person inside of a month have a typical vaccine vesicle come again, and I have seen that same person inside of two years have a third vesicle. Thus we learn that immunity and saturation are two distinct things. You might be immune and not saturated.

There is another question to be considered, the method of vaccination. At the time we first began to vaccinate we vaccinated by a free, deep

incision. I have found by experience that that is not necessary now, and in thousands of animals that I vaccinate at the present time you will probably not see a drop of blood for twenty or thirty consecutive cases. What does that teach? It teaches you are carrying the organisms on the skin into the deeper tissues, and you have necrosis there, and may not have vaccination at all. At the present time the vaccination is done in such a way that we get the typical vesicle every time.

There are so many questions growing out of this that it seems impossible for me to know where to begin and where to stop, but I want to call your attention to one thing, and that is immunity. The doctor has already called your attention to the fact that in England there must be three or four different insertions. In this country they use a single insertion. I think the truth of the matter is, and by reading recent British literature you will find it to be true, that they require from half an inch to an inch of surface at least. That was formerly overcome in the United States by making a larger incision. I have seen incisions that would almost cover a silver dollar. Now, we recommend using the pin point incision. We don't get the area necessary to protect the person. Why not take up the question of having sufficient amount of protection by a number of insertions? The German Government does it thoroughly, and uses as high as six insertions, and as the result of that in 1899 they had six cases of smallpox in the whole German empire, and most of those cases were on the borders of Germany. There they follow a child up until the eleventh year and then he must be re-vaccinated. So I think, gentlemen, the line of investigation should be as to the thoroughness and the completeness of the amount of immunity rather than taking up the old line, which I think is being discarded.

Dr. D. H. Beckwith, Cleveland, O.—For about twenty-five years I used human virus. I had it placed in my arm when I was six years of age. I have been through three epidemics of smallpox and have been vaccinated at least twenty times in the last fifty years. The virus only produced a slight irritation on my arm; a very little scar is all that has been produced by the first vaccination. Dr. Probst knows that I have been in active work in the State of Ohio for a good many years, and we have consulted more or less in regard to smallpox. Now, if I could always secure good healthy children I would use their virus in preference to much of the virus that we get at the present time. I have used the glycerine tubes for the last few years and get just as bad sores on the arm as with the points. Therefore, in Cleveland we have been using the points almost exclusively. One ought to be as good as the other if properly made. There are a great many cases where we have had bad arms and bad legs. The virus in many cases

must have been unreliable. If you give us the right kind of virus I believe vaccination will prevent smallpox. Three years ago we had five hundred cases of smallpox in Cleveland. Last year we had about a thousand cases. The people were not educated up to being vaccinated. Our Boards of Health simply did the best they could. March, 1901, we had a new administration with Tom Johnson at the head. He went to all the institutions and insisted that the employes should be vaccinated. The employers of the city, manufacturers, stores and shops told their men that they would have to be vaccinated or quit their employment. Also vaccination was done in all of our public schools. In four weeks after the work began we had the city well vaccinated. What is the result? Our Health Officer said two weeks ago that there was not one case of smallpox in Cleveland. I believe one mark is as good as three if it is well done, and just as effectual. I have treated many cases of smallpox, and that is my experience. Our Health Officer said that something must be done to disinfect the houses of smallpox patients and formaldehyde was used through all the lower portions of the city homes where they had had smallpox. With what result time will prove.

Dr. Peter H. Bryce, Toronto.—I am much pleased, Mr. President, at the discussion which has taken place and especially pleased at what we have heard from Dr. Licéaga, as well as Dr. Durgin, while we have been gratified to learn, too, through Dr. Elgin, that the producers of vaccine have still very much to learn. We all have very much to learn. I am indeed a little surprised that they are able as we are told to produce regular normal vaccine day after day by superficial incision. In the last report of Great Britain I find it there stated that during the warm, hot summer and in the autumn the calves, owing to poverty of blood, or other condition, produce very little vaccine, and a vaccine which was unusually inert. Now, if that is true then I have no doubt it is true as affecting the general conditions in other places, and were the time ours I would very much like to ask Dr. Elgin a great many questions, which I do not propose to do; but there is one thing that does strike me, which is: Whether we as users of vaccine, of one form or another, have any guarantee of the honesty and carefulness of the producer, and that this or that batch of vaccine that comes from the heifer today, seemingly normal on the fourth or fifth day after the calf has been vaccinated, has really produced in a primary human vaccination on the seventh or eighth day a vaccination of a normal character. If it is true, then I have a great many things explained to me; but if it is true that they give us a

lymph which has been tested, then I have yet more difficulty. I do trust, as Dr. Durgin has said, that a committee will be appointed to take up this question, and bring in a report next year, with the widest amount of experience we can get, because I feel that the reputation of the great Jenner's discovery is at stake. It becomes more difficult every day to deal with this question of leaving the matter of vaccine production in the hands of ordinary producers and ordinary doctors.

On motion, adjournment was then taken until 8 p. m.

First Day—Evening Session.

The Association reassembled at 8 P. M., and was called to order by ex-President Dr. William Bailey.

Dr. Carey, on behalf of the Local Committee of Arrangements, invited all members of the Association to avail themselves of the privileges of the Buffalo Club. He also announced that at 4 o'clock tomorrow afternoon the Buffalo Crematory Building would be open for inspection by the members of the Association.

The Chairman.—The next matter on the program is the address of welcome, by the Mayor, who, I am sorry to say, is absent from the city, but is well represented by Mr. Wilcox, of Buffalo, whom I now have the pleasure of introducing to the audience.

Mr. Ansley Wilcox, of Buffalo, then read the "Address of Welcome."

The Chairman.—It is a pleasure to have been welcomed by Mr. Wilcox, inasmuch as we feel particularly drawn towards him just now from the fact that in his house the new administration began.

The address by the President, Dr. Benjamin Lee, of Philadelphia, Pa., was then read by Dr. Gihon. (See page 1.)

On motion, an adjournment was then taken until 10 o'clock Wednesday morning.

September 18, Second Day—Morning Session.

The Association convened at 10 A. M. on Wednesday morning, and was called to order by the President.

The Secretary announced that the Executive Committee had considered the resolution with reference to the army canteen, and recommended its adoption, amended as follows:

"*Resolved*, That this body deplores any action in curtailing the operation of the army canteen or post exchange, and in the interest

of general and military sanitation and temperance recommends their establishment as formerly existing in the United States."

Dr. Durgin moved the adoption of the resolution. Seconded.

Dr. Munson, of the United States Army, was requested to read a paper prepared by himself on the subject of the Army Canteen, which he did. (See page 315.)

Colonel Greenleaf, U. S. Army.—I can only say that I heartily concur in the remarks that you have heard from Dr. Munson on this subject. I have just returned from nearly two years' service in the Philippines and visited a large number of military posts. I can say from personal observation that the general consensus of opinion among the officers and soldiers in the Philippines is that they have suffered a severe loss to their general comfort by the curtailment of the privileges of the canteen. If it is really the purpose of the people of this country to consider the comfort of the soldier there will be no hesitation whatever in the restoration of these privileges. I sincerely trust that the action of this Association may be in favor of its restoration, and that the great weight of the opinion of the men who have gathered here will produce such a result.

Dr. Albert L. Gihon, U. S. N.—I am in a position to be able to speak on the other side. In the Marine Corps, where they have had no canteens, they have had establishments kept by sutlers, or "post traders," who were usually widows of officers. While I was attempting to get a canteen on the army basis established at a certain post I was confronted by political influence and it was said: Do you wish to take the means of living from this estimable lady? She had built a house and lived in good circumstances and made two or three thousand dollars a year clear. If there had been a canteen there all the profits of that post would have been used among the men themselves. This view of the case has not been brought forward strongly, but it is really one of the most pertinent and strongest arguments in favor of the establishment of the army canteen. The money which would otherwise go for the benefit of the men was spent for the enrichment of the lady sutler. I hope this Association will pass a strong resolution indorsing the army canteen. It is a resolution that we have a right to ask our Canadian and Mexican fellow-members to join with us in expressing in the strongest terms possible the horror that this Association entertains of this backward step in sanitation, and may I add, in temperance, too? At this sutler's post to which I have referred it was said you could buy nothing but port wine. I said to the commandant of the station: "I will give you a sample," and in half an hour I had obtained indirectly a pint of "Port wine," which

was only colored alcohol. That is the kind of stuff that is sold at sutlers' posts.

Let it go abroad as the opinion of this Association as a sanitary body that it is absolutely necessary in the interest of temperance and public morals that the canteen be established on its old basis.

The resolution was carried unanimously.

The Secretary further announced that the Program Committee, with the approval of the Executive Committee, had arranged for a morning session on Thursday morning at 10 o'clock to hear the report of the committee appointed to adopt resolutions upon the death of President McKinley, and that immediately after the adjournment there would be a meeting of the Advisory Council.

A number of applications for membership to the Association were read by the Secretary.

Dr. Durgin moved that the Secretary be authorized to cast the ballot of the Association for their election. Seconded by Professor Brewer, and carried.

THE PRESIDENT.—The Chair will nominate Colonel Charles R. Greenleaf, a member of the Advisory Council, representing the Superior Board of Health of the Philippine Islands; also Dr. William F. Smith, as representing the Superior Board of Health of Porto Rico.

It will be remembered that the unfortunate prolixity of the President's address last night crowded out two papers of great interest which had been promised for the evening. The Chair will therefore call upon Colonel Greenleaf to read his paper.

Colonel Charles R. Greenleaf, Chief Surgeon, Philippine Islands, then read his paper entitled "A Brief Statement of the Sanitary Work so far Accomplished in the Philippines, and the Present Shape of Their Sanitary Administration." (See page 157.)

Dr. William Fawcett Smith, Secretary and Treasurer of the Superior Board of Health of Porto Rico, presented a paper on "Sanitation in Porto Rico." (See page 166.)

THE SECRETARY.—I beg leave to report a resolution from the Executive Committee, as follows:

"The Executive Committee recommends that a standing committee be appointed to investigate the problem of how best to secure to the public, supplies of normal vaccine, and how best to insure its use by medical practitioners and public vaccinators so as to obtain from vaccination the highest degree of immunity against smallpox with the least pathological result."

The motion was seconded by Dr. Stanton, and carried

THE PRESIDENT.—The Chair will appoint Dr. Salmon, of Washington; Dr. Bryce of Canada, and Dr. William M. Welch, of Philadelphia, as such committee.

Mr. George W. Fuller of New York City, Chairman of the Committee on the Pollution of Public Water Supplies, reported as follows:

This committee has decided that formal joint reports, such as made last year, had in the future best be submitted once in three to five years. In the meantime it is proposed by the committee to devote itself to the preparation of new evidence on those topics previously dealt with; and, further, to the development of those topics which are not yet in such form that the evidence can be set forth in conclusive and concise terms.

During the past year the committee has been gathering information relative to the various topics mentioned in our last report. Concerning the question of vital statistics, particularly typhoid fever death rates, in their relation to the pollution of public water supplies, the data are not as complete as hoped for, but for American cities of over 30,000 population the typhoid fever death rate for each of the last three years can be submitted. If it meets the pleasure of the Association, we would be glad to have these data printed in the Proceedings of this meeting. (See page 100.)

The principal work of the past year has been the accumulation of evidence referring to the legal status of water pollution. This has been undertaken by two members of our committee, Dr. Leal of Paterson, N. J., and Dr. Wesbrook of Minneapolis, Minn. In the original assignment of topics it was planned to have Dr. Leal investigate this subject particularly from the standpoint of litigation and with reference to leading court decisions; and to have Dr. Wesbrook compile the available evidence with regard to legislative measures upon which various health boards are now operating. Further, it was planned to have the evidence along these lines summarized in such form as to be of ready assistance in discussing this subject with the view to outlining improvements. In carrying out these arrangements it has been found that the subdivisions of this topic overlapped very considerably, and in fact it became necessary for Dr. Leal to consider it as a whole. The committee feels much obligated to Drs. Leal and Wesbrook for the information which they have secured and prepared in summarized form for presentation to this meeting.

In the field of water purification and sewage disposal the leading evidence stands now in substantially the same form as was the case a year ago. The intervening period has been chiefly characterized in

connection with water purification by actual construction work on a much larger scale than has been the case hitherto in this country. While the past year is notable for the application of principles previously developed, there have been a number of important studies under way with especial reference to the preliminary clarification of turbid waters and to the removal of color, tastes and odors. The results of these investigations, however, are not yet available.

Dr. John L. Leal of Paterson, N. J., member of the Committee on the Pollution of Public Water Supplies, submitted a report prepared by himself, dealing with the legal status of water pollution. (See page 103.)

Dr. F. F. Wesbrook, Minneapolis, Minn.—At the time when the work was originally assigned I had considerable amount of work to do, which was found to be included in Dr. Leal's report. I wish to ask that Dr. Leal be given full time and I will forego any remarks which I have to make on the subject. In making this suggestion I appreciate the value of what Dr. Leal has summarized.

Dr. H. M. Bracken, Minneapolis, Minn.—Mr. President, I would like to make a motion. Mr. Fuller referred to having the death rate statistics for typhoid fever in cities having a population of 30,000 or more. I move you that the Publication Committee be urged to embody those statistics in the report of this committee of which Mr. Fuller is Chairman.

The motion was seconded by Dr. Montgomery. Carried.

Dr. C. P. Wilkinson of New Orleans, La., Chairman of the Committee on Etiology of Yellow Fever, reported as follows:

As acting Chairman of that committee, I have no report to make. The former Chairman, Dr. Horlbeck, recently deceased, had accumulated a large amount of data and promised us an interesting report. Owing to his lamentable death this report has not been presented, but I will endeavor to secure the data from his relatives so that it may be printed.

The President: The Chair will appoint Dr. Wilkinson Chairman *pro tem.* of that committee in consequence of the death of Dr. Horlbeck.

Dr. H. W. Hill of Boston, Mass., read a paper prepared by Dr. Alvah H. Doty, Health Officer, Port of New York, entitled "Practical Discussion of Yellow Fever." (See page 134.)

Dr. Walter Reed, Surgeon, U. S. A., followed with a paper on "The Prevention of Yellow Fever." (See page 113.)

On motion, an adjournment was taken to 3 p. m.

Second Day—Afternoon Session.

The Association reassembled at 3 p. m., and was called to order by the President.

The Secretary announced that the Executive Committee had considered the resolution that was handed in with reference to the general subject of Tuberculosis and would report back as a substitute the following resolutions and recommend their adoption:

"*Resolved*, That notwithstanding the advances of sanitary science the mortality from tuberculosis continues to be appalling. It has been demonstrated that by the application of proper measures this mortality may be diminished rapidly and to a great degree. Therefore, every effort should be made by sanitarians to carry into effect all reasonable methods which have been shown by experience and research to be efficacious towards this end.

Resolved, That the increase of tuberculosis in cattle and swine, as shown by investigations of recent years and by meat inspection statistics, is a serious matter from a commercial as well as sanitary point of view, and calls for more systematic attention from those responsible for the integrity of the food supply and for the protection of the public health.

Resolved, That this Association is of the opinion that sufficient facts have not been offered by Professor Koch or other investigators to prove that human and bovine tuberculosis are different diseases; it is further of the opinion that the variability under different environment common to microorganisms may, on further investigation, be found sufficient to account for the differences that have been noted, and that the germs of these diseases may yet be proved to be closely allied or identical. Irrespective of the question of the communicability of bovine tuberculosis to man, the inspection of animals and premises is absolutely necessary in order:

1. That the meat and milk of animals suffering from this and other constitutional diseases be not used as human food;

2. That the sanitary condition of dairies, stables, etc., as regards cleanliness, water supply and ventilation may be maintained;

3. That the health of dairymen and other handlers be closely supervised to prevent the spread of diphtheria, scarlet fever, human tuberculosis, etc., through the milk supply.

Resolved, That this Association, while desiring to express its positive opinion as to the importance of dealing with animals and their products as indicated in the preceding resolutions, does, at the same time, insist upon the necessity for dealing with the still greater dangers now universally recognized, of the transmission of tuberculosis from one person to another by continued personal association through inhalation of the air of infected living rooms, the contamination of clothing, handkerchiefs and similar objects with sputum and other secretions, and would therefore urgently recommend that municipalities adopt regulations, as follows:

1. Against expectoration on pavements and in other public places.

2. For the compulsory notification by physicians of cases of tuberculosis in order that literature may be supplied to householders and municipal aid given where necessary to lessen the dangers to the families of infected persons.

3. For the establishment of municipal sanatoria for the benefit of persons and families of limited means.

4. For the regular inspection of tenements, factories, workshops, schools and other public institutions to promote cleanliness, ventilation and other sanitary conditions."

It was moved by Dr. Gihon that the resolutions be adopted. Seconded and carried.

THE PRESIDENT.—The Chair will announce the appointment of Major W. C. Gorgas as a member of the Advisory Council, representing the Government of the Island of Cuba.

Dr. A. N. Bell of Brooklyn, N. Y., forwarded to the Association a paper entitled, "Fomites and Yellow Fever." As Dr. Bell was not present, his paper was read by title. (See page 144.)

Dr. W. C. Gorgas of Havana, Cuba, contributed a paper entitled, "Results of Sanitation of Yellow Fever in Havana, Cuba, Based on the Theory that the Stegomyia Fasciata is the Only Means of Communication of Yellow Fever." (See page 130.)

Dr. Eduardo Licéaga, President of the Superior Board of Health of Mexico, Mexico City, presented a paper entitled, "Tenth Report on the Cases of Yellow Fever which have been Observed on the two Coasts of the Mexican Republic from the 17th of September, 1900, to the 31st of August, 1901." (See page 152.)

DISCUSSION OF THE PAPER OF DRS. REED AND GORGAS.

DR. FELIX FORMENTO, New Orleans, La.—I listened with the greatest pleasure to the papers of Drs. Reed and Gorgas, and I thank them very much. It will be to a great many a revelation. No one admires more than I do the immense progress in sanitary matters in Havana since the American occupation, and hope what I will say will not be taken and cannot be taken as an unfair criticism. All honor to the one who was the first to advance the theory that yellow fever was communicated by mosquitos, and to you, gentlemen, who have demonstrated it. The result of these experiments in my mind is this: That it has been proven without a doubt that a certain mosquito is a carrier of yellow fever, which is thus communicated from man to man. Does this mean to say that there is no other way of communicating the disease? Is the mosquito the only agent by which yellow fever can be communicated? I beg to say that I think it is not the only means of communication of the disease. The experiments which

have been made on a few subjects are certainly of great importance, and prove that the mosquito transmits the disease. Had these experiments been repeated outside of the yellow fever country and where there could be no other possible suspicion of communication they would have had still more weight. For instance, if an infected mosquito was carried to New York, and an experiment made at New York, outside of all local influence, and gave the same results, it would add a great deal to the experiments already made, which, however, I accept as conclusive. It is not, however, for me the only method. How simple would the problem be if the disease could disappear by exterminating the mosquito. I am certain there is an analogy between this disease and tuberculosis, which we studied yesterday. We should not by receiving the new discovery throw away at once as worthless the experience of centuries. There are many real examples of the transmisssion of yellow fever by fomites. I will give you one or two instances. Yellow fever broke out in Madrid a few years ago in a house where a trunk had arrived from Cuba, which had been closed for several months, and which belonged to an officer who had died in Havana. Two or three days after the trunk was opened well authenticated cases of yellow fever were discovered in the house. Could mosquitos have lived three or four months in that trunk? The length of life of the mosquito is said to be five days when enclosed in a box with no dampness or humidity. That is one case which cannot be explained by the mosquito theory.

How do you explain this other fact, just as remarkable? During the occupation of Mexico by the French a few years ago, a brig left a Mexican port for Brest in the north of France, where there are no mosquitos. During the voyage there occurred several deaths from yellow fever. They arrived at their destination, and before they landed, while in the port, the boat was fumigated and disinfected and it was noticed a few days after that workingmen who had no direct communication with the ship but who worked within a short distance, on the wharf, were taken down with yellow fever. They had no communication with the ship, but there was a current of air blowing in that direction. Two, I think, died. The others recovered and there were no other cases. And the epidemics of Cadiz, Barcelona and Livorno (1821)! Were they also due to mosquitos?

Therefore, I say that while admitting the possibility of the transmission of yellow fever by the mosquito we still admit its transmission by fomites. We should not, all at once, forget everything we have learned and known for centuries.

Dr. Eugene Wasdin, Buffalo, N. Y.—The words of Dr. Formento have given me the cue as to what I desire to say upon this question.

To my mind there is a cloudiness about it which depends upon the fact that we have lost sight of the organism which produces the disease. The fact that Dr. Reed states that the organism has not yet been discovered does not make that true. The organism has been discovered, and it is not inconsistent with Dr. Reed's demonstration of the transmission of the disease by the mosquito, to accept the organism of Sanarelli as the cause of yellow fever. The real reason of this obscurity is that he has ignored the peculiarities of this organism, an organism capable of giving rise to two developments, one extremely toxic, and the other of less toxicity but of marked septic power, and the diseases produced by the stegomyia are simply the septic types of the disease from the *convection* of this bacillus into the circulation.

Yellow fever can be produced naturally by the entrance of this bacillus into the system *per vias naturales*, and the passage of the organism into the blood is followed by the septic symptoms characteristic of the disease.

The cause of the disease, as I have said the bacillus icteroides, has been thoroughly experimented with, and the results demonstrate its etiologic value. This can all be done over again, and I guarantee that every observation made by the Commission of the Marine Hospital Service can be refulfilled.

Every postulate of Koch has been fulfilled, and more than that the organism has given rise to yellow fever in animals in epidemic form in the same way as we have found it to do in man.

The most important point before you is that of the possibility of the carriage of the bacillus in fomites. Dr. Formento has just declared that he believes that the disease can be conveyed in fomites, and so do I believe it, from the indubitable cases on record as derived from this source.

As to the influence of temperature in this disease, I will say that the bacillus icteroides has a characteristic entirely different from that of any organism which I have studied, in that it is quickly attenuated by exposure to cold. It will produce yellow fever at 62°-65° Fahr., but it takes twice the length of time to produce the results at that temperature as at 75°-80° Fahr., while at 42° Fahr., the frost line, the organism does not produce the disease at all from its attenuation by cold, nor does reheating the germ itself after such exposure to cold revive its power, as shown by Dr. Reed's experiments.

I will here make use of Dr. Reed's chart showing the influence of the temperature upon the mosquito, which will sting, and breed and transmit the disease *only* when the temperature is considerably above 42° Fahr., or the frost line, since at this temperature the mosquito

becomes benumbed. At higher temperatures, say 62° or 65°, the mosquito, he says, shows a more pronounced power to transmit the disease, and at 75° to 80°, or a summer temperature, this transmission is most perfect, the disease taking place usually within twelve days after the sting of the mosquito.

It is plain that Dr. Reed's temperature chart for the mosquito corresponds accurately with the facts of the attenuation of the bacillus icteroides as I have demonstrated them to the satisfaction of some of the best observers at the Pasteur Institute in Paris; and these facts correspond to the clinical and natural characteristics of the disease as we know it at the bedside. Whether the stegomyia may breed or not breed, live or not live at the temperatures shown by Dr. Reed, I do not know; I only know that the bacillus icteroides reacts to temperature changes in the same manner.

The question of quarantine which comes up very naturally is one of the most important that can occupy the attention of this august body. Shall we displace all our well tried and known methods of quarantine?

The failure of Dr. Reed to find the bacillus causing the disease in the cases he studied is no proof whatever of there being none. For years New Orleans, and the South, has been kept free from yellow fever by the exercise of our present methods of quarantine without any regard for the welfare of the mosquito, and although Dr. Reed has demonstrated to my mind that the disease may thus be transmitted, it is not the only way by which we can contract the disease, and when contracted from the mosquito I deem it but an artificial infection such as we produce in animals in our laboratories, and as Dr. Reed has produced in man with his hypodermic syringe independent of the stegomyia.

Dr. Walter Reed, U. S. A.—Will Dr. Wasdin please tell me in the transmission of malaria by the bite of the mosquito, whether that is also simply a laboratory disease?

Dr. Wasdin.—As we know the cause of malaria and Dr. Reed says that we do not know the cause of this disease, I do not think the question a fair one, for there are certain natural conditions of disease, and if we get them confounded with the artificial conditions the confusion may be lasting. However, if a mosquito, bearing the sporozöides of the plasmodium malariæ in its body, should die and become macerated in the water of her habitat, and if these coccidia or spores should become liberated in the air or water, and be taken into the system, is there any evidence to show that such spores may not germinate in the tissues and produce the disease naturally?

These spores are the ultimate facts, with which we are acquainted, of a bygone malarial fever; we know nothing of their further possible germination save through the proboscis of the stegomyia, nor of the possible higher animalcular life of which the malarial plasmodium may be only a cycle. The fact of injecting these spores makes the disease artificial.

Therefore, I would appeal, as an officer of the Marine Hospital Service who has served at the National quarantine stations, and has honestly done his duty in investigating this disease—I appeal to this Association against the proposition to modify our quarantine restrictions, since it is not reasonable to accept the unproved dictum that yellow fever is transmitted solely by the stegomyia fasciata, if by so doing we displace the theory that has given us safety during all these years.

Dr. Milton J. Rosenau, Washington, D. C.—I wish briefly to add my words of congratulation to those of the whole scientific world in praise of Dr. Reed and his colleagues, who, in my opinion, have given us a work which has not been equalled, as far as its benefits to the public health are concerned, since Jenner gave us vaccinia. The mosquito carries yellow fever. There may be other means of carrying it. I believe that we can, from a sanitary standpoint and from a public health standpoint, disregard other measures until they are proven. They have not yet been proven. I would like it distinctly understood that my views are personal, although I am a member of the Marine Hospital Service. This map is the "proof of the pudding." We could not have a better argument than that, and I think all honor should be given to Major Gorgas for the brilliancy of the work which results in a diagram and figure like this.

I have only one fact to add to what has been presented today concerning the transmission of the disease. It has been a time honored custom to disinfect baggage in order to prevent the spread of this disease. Now, it is a great question whether it is necessary to disinfect or treat baggage in any way in order to prevent the disease spreading. Dr. Reed has told us today that baggage may carry the mosquito for five days. Major Havard, quoting a letter of Dr. Harvey, told us how the mosquito has been carried from Neuvitas, Cuba, to New York, a period lasting about thirteen or fourteen days, and in the experiments which have been conducted with the mosquito in the hygienic laboratory of the Marine Hospital Service in Washington during the summer months, we have often kept mosquitos in trunks, in order to prove this very question, for a period of ten days. The condition, as Major Reed has already pointed out, essential to keep them alive longer than a few days, is water. It is not

necessary that water be present in the trunk, as such. Moisture is sufficient. In our particular experiments we put the mosquitos in a little pill box. We replaced the pasteboard lid with one of mosquito netting, and then wrapped this little box up in a damp handkerchief or a dry towel, and then packed it away in our trunk, under different degrees of temperature and moisture in order to see whether the mosquito would live any length of time. The evidence seems to be plain that a mosquito can travel in a trunk or box, and therefore there is a certain amount of danger in carrying mosquitos from Cuba to parts of this country in baggage. It is not more than five days from Havana to New Orleans by boat. Just how great this danger is I cannot say. However, we have here a scientific justification of the time honored custom of the disinfection of baggage, which experience has taught us for many years to be one of the means in our fight against the spread of yellow fever.

Dr. Walter Reed, U. S. A., closing the discussion: I, for one, thoroughly sympathize with the position taken by Dr. Formento in this discussion. We must look at the situation in the light in which the physicians of New Orleans view this matter. As I stated, this morning, that city has had more deaths from yellow fever than any other city in the United States, and hence if we find that the gentlemen in New Orleans, while prepared to accept the theory of the transmissibility of yellow fever by mosquitos, are not willing to accept this as the only method of transmission, we should not be much surprised at their attitude. It is perfectly natural that gentlemen who come from a city, so afflicted as New Orleans has been, should be unwilling to accept the mosquito as the only means of transmission of this disease. We should not expect that their views would undergo, all at once, such a radical revolution and that they should abandon fomites as a means of transmission. We have expected much criticism on their part, and we certainly cannot object to this. Let me say here, that we have always invited the fullest criticism of our work in Cuba. It was for this reason that, during the time these observations were being made, we requested the most expert physicians in Havana, including the officers of the Marine Hospital Service, who have done such excellent work in keeping yellow fever out of the United States, to visit our Experimental Station, and to see for themselves everything that we were doing, for we fully realized that if our work would not withstand the most searching criticism, it could have no real value.

Dr. Formento has given an instance of the importation of yellow fever into Spain by fomites. I dare say this is the epidemic of 1878 in Madrid, to which several writers have made reference. If so, the

facts are about as follows: 19,000 soldiers returning from Cuba were disembarked at a Spanish port, 10,000 of these going direct to Madrid by rail. Sometime thereafter yellow fever began at a point in the city where a small detachment of soldiers had lodged. If fomites is responsible for the outbreak, what seems remarkable is that only one small detachment should have carried infected clothing out of ten thousand soldiers who reached Madrid and dispersed throughout the city. Does not this appear, to say the least, highly improbable? Is it not more reasonable to believe that a case of mild yellow fever was imported amongst the men of this small detachment? Certainly, if gentlemen still believe that fomites can carry yellow fever, they should bear in mind that we left no means untried in order to produce the disease in this way.

Dr. Wasdin, Buffalo, N. Y.—Was the experiment with fomites carried on at the time of the year in which the bacillus icteroides is most active or absolutely inactive?

Dr. Walter Reed.—I was going to reach Dr. Wasdin's objections in a little while, but perhaps I had better answer him now. So far as bacillus icteroides is concerned, our observations have shown that this bacillus has nothing to do with the causation of yellow fever. This was clearly brought out in those cases of experimental yellow fever which were produced by the subcutaneous injection of blood. In these cases, as soon as we had injected a certain quantity of the blood of a patient having yellow fever, under the skin of the non-immune subject, we immediately thereafter drew a somewhat larger quantity of blood and transferred it to sterile bouillon, diluting it fifteen or twenty times. Now the very same blood that, thus injected, produced yellow fever in the non-immune subject and hence must have contained the specific agent of the disease, did not contain bacillus icteroides, as shown by its failure to appear in any of our culture media. Bacillus icteroides is not a difficult organism to grow on our laboratory media and should not, therefore, be hard to isolate when present in the blood, Dr. Wasdin to the contrary notwithstanding. It seems to me a waste of time, with all due respect to Dr. Wasdin, who has labored so hard over this problem, to longer consider this bacillus as the cause of yellow fever.

Although we worked at the season of the year when yellow fever was on the decline in Havana, we took means in our infected clothing building, through artificial heat, to keep the temperature at an average of nearly 80° F. Not only that, we also kept the atmosphere moist. We never allowed sunlight to enter the building, and yet not one of the seven non-immunes who slept in this house and in the very

garments worn by yellow fever patients, during a period of sixty-five nights, contracted the disease. During this same period we were producing yellow fever at the ordinary temperature of the outside air by the bites of infected mosquitos, and the disease was still continuing in Havana.

Now, gentlemen, when you speak of fomites as a means of transmission and of the danger of a yellow fever patient infecting his bedding or clothing, you should not forget that yellow fever is such a peculiar disease, that while a patient can infect his clothing in New Orleans, he cannot do so at Asheville, N. C., or at Atlanta, Ga., even though he die with black vomit! Perhaps some one present can explain why. In Philadelphia towards the close of the great epidemics of 1793 and 1798, prior to the days when disinfectants were used, one could hardly say how many tons of infected bedding and clothing must have been contained in the houses of that city; and yet with the advent of cold weather yellow fever rapidly subsided, although there still remained such an abundance of fomites. Did the advent of frost so promptly disinfect the fomites or did it drive away the infected mosquitos?

There is one other point to which I would like to invite your attention; it is this; whenever a case of yellow fever arises as the result of supposed exposure to fomites, the case develops promptly, that is after a few days, corresponding to the short period of incubation of this disease; but, on the other hand, when an individual sick with yellow fever enters a town, where the conditions are favorable for the propagation of the disease, a second case does not occur until after a considerable period—two to three weeks. I need hardly add that this interval corresponds to the mosquito interval, as our observations have shown.

Dr. Felix Formento, New Orleans, La.—Do you consider the mosquito as the only means of transmission of yellow fever?

Dr. Reed.—Yes. I do not believe that nature works in two such radically different ways as would be required in the transmission of yellow fever by the bite of the mosquito and by contact with fomites. Moreover, the transmission of the disease by the mosquito meets every requirement of the case, whereas its propagation by fomites, or by other means, is vulnerable at every point.

As regards the danger of importing infected mosquitos in baggage, to which Dr. Rosenau has given his assent, based on certain observations that he has made, let me say that the conditions under which Dr. Rosenau kept his insects in trunks are such as would not occur in the ordinary transmission of baggage. His observations are of inter-

est as bearing on the length of life of this mosquito under certain conditions, but it must not be forgotten that Dr. Rosenau was careful to supply his insects with water by means of a moistened handkerchief wrapped around his pill-boxes; and to insure access to this water by a single layer of mosquito netting placed between the insects and the wet handkerchief. In other words, Dr. Rosenau not only protected his insects from injury but supplied them with the moisture necessary to keep them alive. But when one packs his trunk, he generally packs it with dry articles of clothing and he does not put his mosquitoes in pill-boxes nor provide water for them in transit. In our own experiments, the mosquitos were placed in large glass jars, covered with mosquito-netting, after having been permitted to fill themselves with blood. If under these favorable conditions, with plenty of air and facilities for exercise, they are all dead by the expiration of the fifth or beginning of the sixth day, we can hardly believe that they would survive so long when packed amongst articles of clothing and subjected to the rude handling of baggage. It is because of the frailty of this insect and of its need for water, that we do not consider its importation in baggage as a source of danger.

Mr. Rudolph Hering, C. E., New York City, Chairman of the Committee on Disposal of Refuse Materials, made the following report: (See page 184.)

DISCUSSION ON MR. HERING'S REPORT.

Dr. Samuel H. Durgin, Boston, Mass.—I cannot help expressing a little surprise that at the end of so many years of investigation we cannot have something more definite as a conclusion. The country is looking for these conclusions from scientific sanitary bodies. Municipalities are impatiently waiting for these conclusions. I would like to ask the chairman of this committee whether or not it is a fact that two or three main questions involved have not been already regarded as fairly settled. First, we have the two systems, the reduction system and the cremation system. I would like to ask the chairman if it is not a fact under his investigations and observations that the reduction system is one which always offends the sense of the people near it and whether it is not a very offensive process in every instance. I would like an answer, yes or no, to that.

Mr. Rudolph Hering, New York City.—Mr. Chairman, this question cannot be answered by yes or no. If we had an ideal system we might possibly answer it.

Dr. Durgin.—Have you found any reduction process that is not a nuisance to the neighborhood?

MR. HERING.—I have not yet seen such a process conducted in a way so that either in the immediate neighborhood or within a few miles these invisible clouds of odorous air, as you may call them, when descending will not become perceptible. This is a question, however, not to be settled off-hand in that way, as I think. As there is an opportunity for the utilization of a part of the refuse, it seems to me, as Dr. Woodward has stated in his paper, we are not in a position to deprive others from getting out of this refuse whatever of value they can, provided it will not be a nuisance to the neighborhood. So far the evident result has been a nuisance in every case in this country where the reduction works have been erected. Works of this kind, as in Washington, have been put so far away from the city that, if there are any odors, they will not be objectionable. I do not think that any one will say that you can destroy garbage by the reduction process without occasionally making an odor, and still be profitable to the investors.

DR. SAMUEL H. DURGIN, of Boston, Mass.—I really believe that my point was so plain and took up so small a part of the question that it ought to be answered without discussing the whole question, and thus depriving me or others of the opportunity to discuss this paper. I ask the plain question, does the chairman know of any reduction process in this country or any other country, that has not been a nuisance to the neighborhood, and I understand him to say "No." Am I right?

MR. RUDOLPH HERING, New York City.—In the neighborhood of the plants there has always been an occasional nuisance.

DR. DURGIN.—Within a radius of one or two miles?

MR. HERING.—A mile perhaps.

DR. DURGIN.—Now, I want to ask the chairman if it is not true that he has found already crematories for garbage that were not in the immediate vicinity of the plant a nuisance?

MR. HERING.—I have found crematories, but not in this country, that I think consume the garbage without making a nuisance, such as in Hamburg and in some English cities, on which we reported four years ago.

DR. DURGIN.—Then, so far as the evidence goes, we are entitled to know, and the municipalities of this country are entitled to know that the one is a nuisance and the other not always a nuisance. I have seen them in this country in the immediate vicinity of inhabitation and they were not any nuisance whatever. I believe that the commercial end of this question can be left to the municipality, who will

say for themselves whether they will have a nuisance or not, and then whether they will pay the cost if there is a difference between the two plants, and this is what the people of our large cities are today looking for—some statement from this or some other scientific sanitary body.

Now, the plant in Boston is running today and has been for three years. It is said to be the best equipped reduction plant in this world and the latest, and to my own personal knowledge and with my own personal investigation and in common with thousands of residents about it, within a radius of one to four miles, I tell you that it is a great nuisance—one which cannot be borne by the people who are suffering from its odors, and I have today on record more than one hundred citizens who have borne evidence to these facts; and the case is in what condition now—hung up for reconsideration, and it does seem to me that these facts should appear plainly in the report made to this body. It is a burning question and one which should be stripped of every commercial influence and nothing but the naked sanitary facts appear in print.

President Lee.—Do you wish to offer a resolution?

Dr. Durgin.—No, sir; a resolution does not appear to me at the moment to be of service.

Dr. Roberts.—I would like to ask Dr. Durgin the population of a city in the United States where the crematory was not a nuisance within the radius of a mile.

Dr. Durgin.—I have in mind the crematory in the city of Washington which was supervised by one of the most active and trustworthy members of this Association, Dr. Woodward. I personally visited the plant and have learned the history of it through Dr. Woodward, who kept an eye on it during its existence. Dr. Woodward also stated that no complaints are now made against the reduction process because they carried it off so far that it was not a nuisance. They had to get out of the way a considerable distance, just as you will find in every reduction plant in this country.

Mr. Rudolph Hering, New York City.—The report of Dr. Woodward gives the whole history of the plant in Washington, and unless I am mistaken he gives as the reason why the crematory was abandoned the fact that they could not run it without making an odor that was objectionable.

Dr. Durgin.—I visited the crematory with Dr. Woodward, and it was the pride of the city and Dr. Woodward said at the time that it was no nuisance, and there were habitations within 150 feet of it.

Mr. Rudolph Hering, in closing the discussion, said: The committee is as anxious as any one to throw more light on this difficult subject, but it seems to be possible only by the expenditure of a pretty large sum of money on the part of one city or the other, and the making of a scientific and impartial investigation of the matter with experiments on a large scale, such as we have been making in the last ten years with regard to water purification. Such questions cannot be settled off-hand. We simply have to wait until some large city takes the matter up and investigates it on lines that we can all be satisfied with, and finds out the better method for disposing of the garbage. If your committee says any more than it has said, it will be speculative information and we may have to take it back a year or two hence. Unless the facts are indisputable we cannot report them as existing.

Mr. H. W. Clark, Chemist of the State Board of Health of Massachusetts, Boston, Mass., then read a paper entitled, "The Bacterial Purification of Water by Freezing." (See page 204.)

Prof. William H. Brewer of New Haven, Conn., read the report of the Committee on the Relation of Forestry to the Public Health. (See page 209.)

Prof. S. H. Woodbridge, Chairman of the Committee on Car Sanitation, submitted a report which was read by Dr. Henry J. Barnes. (See page 224.)

DISCUSSION ON THE REPORT OF THE COMMITTEE ON CAR SANITATION.

Dr. Eliza M. Mosher, Ann Arbor, Mich.—The resolutions we will all indorse, but I would like to see one thing added, and that is that the broom of the porter shall be discontinued in the passageway of the car. We have all of us sat and received the dust, and I would like to have that added, that the porter's broom be discontinued in the aisle of the car. I move that the following recommendation be added to those presented by the committee: That the dust-brush of the porter shall only be allowed to be used at the front or back end of the car, and not in the aisle.

The motion was seconded.

Dr. Samuel H. Durgin, Boston, Mass.—I believe the use of the dust-brush on the carpet of the floor is the cause of very much annoyance as well as the dusting of the passengers clothing. That is usually done directly into the faces of those who are waiting their turn. I think that should be amended to read that "the broom shall not be used during the journey." I believe the disturbance in the

car, as well as in a building, is a great nuisance and a source of disgust to everybody. If the amendment might be accepted, I would have it include all of the sources of dust within the car during the trip.

PROF. W. H. BREWER, New Haven.—I have had to travel across the plains and across the deserts and I think it would raise a howl among the passengers if we were not able to get rid of some of the dust. Most of us don't care to ride with the temperature high and the windows closed, and I fear that a resolution of that kind would not be received with very great enthusiasm by the travelers throughout our country.

DR. SAMUEL H. DURGIN, Boston, Mass.—I don't believe that one of these resolutions will be received with any more kindness than the rest, and if the preceding resolutions are enforced the dust-brush will not be needed nearly so much. I don't believe that one out of four passengers cares half as much as the appearance suggests. They fear that they will be odd in case they refuse.

DR. ELIZA M. MOSHER, Ann Arbor, Mich.—I accept the amendment of Dr. Durgin.

PRESIDENT LEE.—The question, then, is on Dr. Mosher's motion as amended, namely, that this Association disapproves of the use of the clothes-brush, except at either end of the car, and also of the broom during occupancy of the car by passengers.

DR. HENRY J. BARNES, Boston, Mass.—I understand these resolutions are only recommended, and it seems to me that they should first be recommended to the Executive Committee. In view of the fact that this Association does not act on the recommendations, I don't see that we can make any addition to what has been reported.

DR. SAMUEL H. DURGIN, Boston, Mass.—My idea was that recommending them here would only put them in a little better shape for the Executive Committee. They will have to be discussed by that Committee before they can be acted upon by this body.

THE PRESIDENT.—The Chair considers that this motion will be quite in order.

The motion was then put and carried.

On motion, an adjournment was taken until 8 o'clock this evening.

Second Day—Evening Session.

The Association was called to order at 8 p. m. by the President, Dr. Benjamin Lee of Philadelphia.

The President.—The first paper of the evening session is the report of the Committee on the Cause, Prevention and Duration of Infectious Diseases, by Dr. A. Walter Suiter, Chairman, Herkimer, N. Y. Dr. Suiter, however, has offered to give place to Dr. Hibbert W. Hill of Boston, Mass., who desires to make his report on "Disinfectants and Disinfection."

Dr. Hibbert Hill, Boston, Mass., Chairman, then read the report of the Committee on "Disinfectants and Disinfection." (See page 244.)

The President.—As the paper of Dr. Suiter is somewhat on the same line as the report of this Committee, the Chair would suggest that discussion of the report just read be postponed until after the reading of Dr. Suiter's report.

Dr. A. Walter Suiter of Herkimer, N. Y., Chairman, then read the report of the Committee on the Cause, Prevention and Duration of Infectious Diseases. (See page 227.)

Dr. A. W. Suiter, Herkimer, N. Y.—I have in my possession a few memoranda which have been presented by individual members of this Committee. Three of them are in the possession of the Secretary and are not now at hand. If there is time and patience on the part of those present, I will undertake to read these articles. (Reading memoranda.)

That concludes the memoranda that I have in my possession. As to those in the possession of the Secretary, I move you that they, together with these memoranda, be referred to the Committee on Publication.

The motion was seconded. Carried.

It was moved and seconded that a vote of thanks be extended to Dr. Suiter for his pains in preparing the paper just read. The motion was carried.

The President.—If there is no discussion, I would like to say that a paper was passed which had a place on the program, and the discussion which took place this afternoon on the Disposal of Refuse would scarcely be complete without the presentation of this paper. It is entitled, "Refuse Disposal in the District of Columbia," by Dr. William C. Woodward, Health Officer of the District of Columbia.

It was moved and seconded that Dr. Woodward's paper be read by title and printed in the proceedings. Carried.

On motion, the convention then adjourned until Thursday morning, at 10 a. m.

September 19, Third Day—Morning Session.

The Association was called to order by the President at 10 a. m.

The President.—This being the day which the National and State authorities have set apart as a day of humiliation in commemoration of our late lamented President, the ordinary business of the Association will be entirely given up. There are, however, one or two matters which could be properly attended to, which will take very little time, before the resolutions are presented.

The Secretary presented a number of applications for membership, which having been acted upon favorably by the Executive Committee, were recommended to the Association for election.

Dr. Samuel H. Durgin.—I move that the Secretary be instructed to cast the ballot of the Association in favor of the election of these applicants. The motion was seconded and carried.

The Secretary then cast the ballot of the Association for the election of the new members whose names had been read, and they were declared elected.

Dr. Albert L. Gihon stated that it was customary to refer the report of the Treasurer to an Auditing Committee, and moved that this action be taken.

The motion was seconded. Carried.

The President.—The Chair will name Drs. Bryce and Durgin as an Auditing Committee to report at a subsequent session.

The Chair will call upon Dr. Holton as a member of the Committee on Resolutions to present the resolutions of respect to the memory of our late President.

Dr. Holton then read the resolutions prepared by the Committee, as follows:

"Your Committee appointed to draft resolutions regarding the death of President McKinley beg leave to submit the following resolutions:

Resolved, That the American Public Health Association has received with deep sorrow the intelligence of the sudden and tragic death of the beloved President of the United States.

Resolved, That in President McKinley we recognize the highest type of modern civilization, a patriotic citizen, a Christian gentleman, and a sagacious and enlightened statesman.

Resolved, That we respectfully extend our heartfelt sympathy to Mrs. McKinley in this her hour of bereavement, and to other members of the family.

Resolved, That a copy of these resolutions be spread upon the records of this Association and given to the press for publication."

BENJAMIN LEE,
WILLIAM BAILEY.
HENRY D. HOLTON.
FREDERICK MONTIZAMBERT.
E. LICÉAGA.

It was moved by Dr. Durgin that the resolutions be adopted. Seconded.

The Chair would suggest that some members would possibly like to express themselves in regard to these resolutions, and I will call upon Ex-President Bailey.

DR. WILLIAM BAILEY.—Mr. President, and members of the Association: I feel words must fail me to express the depth of sorrow that we all feel. Yet it is a sad pleasure to me to speak a word on this occasion. As expressed I think well in our resolutions, we recognize in the late President all that is best in modern civilization. In every relation in life, as a statesman, as a soldier, and as a Christian, and as to his family relations, we all doff our hats when we contemplate the loyalty of this man to his afflicted wife.

Coming as I do from the South I would like simply to call attention to the fact that no man since the Civil War has done so much as President McKinley to unify this country of ours. Without partisan bias when it came to the Spanish War we found that a Wheeler, a Lee and a Breckenridge were his prominent agents in the carying on of this war, so that to-day in the South as never since 1860 have we had such feeling toward a President or towards the flag of our country. So for this we may be thankful for this man.

The very heinous crime precludes almost its mention and yet allow me to express in this presence that this country since its organization has always been open to receive everybody from other climes who desire to come to us. While that is still our wish for those who come for the betterment of themselves and mankind and who desire to become Americanized, adopting the principles of this Government as their own, yet let me say that the day has come when it must be expressed that we have no place in this country for those who come with the view of promulgating principles that are so much at variance with the principles upon which this Government is founded, and that

there is no longer a place in this country for such spirits to come and concoct their damnable schemes.

Simply then, and briefly, I would urge the adoption of these resolutions in their full spirit, that we do recognize an irreparable loss, that we recognize in this man one worthy of our deepest love, and I am sure that we likewise congratulate ourselves and feelingly return thanks for the expressions that have come to us from our sister nations and I might say from the world. (Applause.)

Dr. C. P. Wilkinson, New Orleans, La.—Mr. Chairman, in seconding the resolution I voice the sentiments of the people of the extreme South, the section from which I come. We were recently favored by a visit from our now deceased President. Our people turned towards him with smiles and extended hands. They held out arms full of flowers and rent the air with their cheers for the man, the citizen and the President. The same bells that then rang out pæans for that man are now tolling dirges as his body lies just about ready to be consigned to the tomb. There is no section of the country that feels more acutely and more bitterly the killing of President McKinley than does the South. He was their friend. In the killing of President Lincoln the South was visited with dire punishment for any hand she might have had in that assassination; and today the South mourns the loss of this President who was the first since that time to extend open fellowship and invite us to join in the house of our fathers in the Union. Today, sir, we find no place for any reflections upon the previous history of any party or any man in that party, but we do recognize the onward march of William McKinley towards prosperity, peace and protection to every citizen of the land regardless of State or sectional birth. We mourn his loss today more than we can express, and on behalf of the South I join in the deepest regret that we have to pass these resolutions; with the most heartfelt earnestness in the truth of every word that they express. (Applause.)

The President.—The Dominion of Canada has already in words most fittingly spoken and full of the deepest sympathy, expressed itself on this question. It would not be inappropriate, however, if at this meeting a further expression should be presented, and I will call upon Dr. Bryce for a word.

Dr. Bryce, Toronto, Can.—Mr. President, Ladies and Gentlemen: It is appropriate that a representative from the Dominion of Canada should have expressed in open meeting here the feelings of admiration for the late President which we all hold and should likewise have expressed feelings of regret for his untimely decease.

At the request of your Executive Committee and your Chairman I am asked to add a few words in connection with this expression of condolence on the part of the Association in the resolution which has just been read. The death of the President is one which must be regretted not alone by the people of the United States, not alone by the people of Anglo-Saxon lineage, but by all the civilized peoples of the earth; but I suppose to no one does that death come nearer than to the people lying to the north, a people who are not only the same in birth and aspirations, but also the same in their daily relations, because we are practically one with you, but especially because we see in the virtues of the life of the late President McKinley so many of those qualities which have been seen in our late Queen, a sort of loadstar to draw every good Briton, and I will say every good citizen of the world, the highest sense, towards the ideal.

The fact that this Association is called upon to pass these resolutions has seemed to me an extremely appropriate thing, since the very aims and objects of this Association are to suppress those very irregularities, whether in society or not, which this sad circumstance has been an illustration of. Sad as the circumstance of the assassination is, it must come home to every one of us workers in the carrying out of the laws of the Almighty, as we understand them, to realize in it that it is one of the necessary results of an unalterable law, whether those catastrophes that we have seen striking society from time to time have affected some innocent person, some whole city, or some whole nation. To us, the work of regulating society comes as close as the regulating of an epidemic or of some catastrophe at sea through an imperfect vessel or some railway collison, which may be due to lack of knowledge of construction or lack of care in managing a train. When we point to the death of the President as an illustration of something, somewhere needing regulation, we feel that it devolves upon us not only to sympathize with the effects of such irregularity incident to the lack of harmony amongst the social elements, but points us still more, it seems to me, in the direction we have so long worked and impels us to work more earnestly and also shows us that in society we are subject to laws which are as unalterable as the movements of the planets, and that if we are ever to see evolved that harmony, which seems to be the purpose of the Creator, we will have to work along all the lines known to us whereby our labors shall go to make up the infinite harmony which are operant with the highest principles, whether of nature or of the Creator. I have only to add that I fully and heartily agree not only for myself but for my country in the resolutions which have been submitted.

Dr. Eduardo Licéaga of Mexico then spoke in Spanish, his remarks being translated by Dr. Gihon. He said:

On the part of myself and my colleagues and my Government in Mexico, I desire to express our heartfelt participation in your sorrow. Referring to Dr. Bryce, I will say that he is practically one of the same people with yourselves and it would be natural for him to feel as you do, but the Mexican race is a different race, different people and speak a different language, but nevertheless our grief and sorrow are equally as profound as yours, and I desire you to feel that we are with you in all the sorrow that you feel yourselves. (Applause.)

The resolutions were adopted by a unanimous standing vote.

The Chairman announced that immediately upon adjournment the Advisory Council would hold a meeting, after which the Executive Committee would meet.

On motion, an adjournment was then taken until 10 o'clock, Friday morning.

September 20, Fourth Day—Morning Session.

The Association reassembled at 10 a. m., and was called to order by the President.

The Secretary announced that the Executive Committee had recommended the adoption of the following resolution:

"The Executive Committee recommends the appointment of a special committee to prepare and publish, at an early date, a pamphlet for public circulation, containing the resolution of the Public Health Association in favor of the Army canteen, together with a concise statement of the data upon which this action was based, and definite references to the original sources from which such information is obtainable; such pamphlet to be issued in the name of the Association, and to be so prepared as to withstand keen and intelligent examination.

This recommendation is made in view of the fact: (1) That an important function of this Association is to educate the public in matters of hygiene; (2) that the action above referred to is in disagreement with the ideas of a very large number of good citizens; (3) that this is a possible opportunity of securing their understanding of our action, and, it is to be hoped, their intelligent co-operation in taking successive steps towards the betterment of existing conditions."

It was moved and seconded that the resolution be adopted. Carried.

The Secretary then read the report of the Committee on Sanitary Aid Societies, as follows:

"Your Committee has been unable to wholly perfect any plan for the organization of sanitary aid societies, which could be submitted

at this meeting, but as it expects to do some definite, practical work during the coming year which will open the way for such organization, it asks to be continued, and to be authorized by the American Public Health Association to prepare at the earliest possible period a plan for the organization and work of such society, and to submit this plan to the Executive Committee of this Association, and if approved by same to submit it to State and local health boards, and to members of the American Public Health Association.

G. W. Goler, Chairman.
Hester M. McClung.
Henry Lomb."

It was moved by Dr. Swarts that the report be received and the Committee continued. Seconded and carried.

The Secretary then read the following resolution, which had been adopted by the Executive Committee, in reference to sanitary aid societies:

"*Resolved*, That the Committee on Sanitary Aid Societies be authorized to prepare at the earliest period possible, a plan for the organization and work of sanitary aid societies, and to submit this plan to the Executive Committee of this Association, and if approved by this Committee to submit same to State and local boards of health, and members of the American Public Health Association.

Also, to take such measures and action which in the opinion of said Committee on Sanitary Aid Societies will promote its work; provided, however, that taking such measures and action are first approved by the Executive Committee of the American Public Health Association."

It was moved and seconded that the resolution, as presented, be adopted. Carried.

It was moved and seconded that a recess of three minutes be taken in order to enable the Executive Committee to act on applications for membership. Carried.

The Association was called to order after the Executive Committee had passed on the applications for membership, and on motion the Secretary was instructed to cast the ballot of the Association in favor of the election of the applicants.

The Secretary then announced that the Executive Committee had recommended that the Standing Committees for the coming year be as follows:

Pollution of Public Water Supplies. Continued.
Disposal of Refuse Materials. Continued.
Animal Diseases and Animal Food. Continued.

Car Sanitation and Steamship and Steamboat Sanitation. Combined and continued.

Relation of Forestry to Public Health. Discontinued.

Etiology of Yellow Fever. Discontinued.

Demography and Statistics in Their Sanitary Relation. Continued.

Cause, Prevention, Period of Incubation and Duration of Infectious Diseases. Continued.

Public Health Legislation. Continued.

Cause and Prevention of Infant Mortality. Continued.

Disinfectants and Disinfection. Continued.

National Leper Homes. Discontinued.

Dangers to the Public Health from Illuminating and Fuel Gas. Continued.

Transportation of Diseased Tissue by Mail. Continued.

The Teaching of Hygiene and Granting of Diploma of Doctor of Public Health. Continued.

School Hygiene. Discontinued.

Committee on Sanitary Aid Societies. Continued.

A new Committee is to be appointed to be known as the Committee on the Relative Immunizing Value of Human and Bovine Virus, to consist of Drs. Bryce, Licéaga, and Dr. William M. Welch.

Dr. H. M. Bracken, Minneapolis, Minn.—I wish to thank the Executive Committee for discontinuing the National Leper Home Committee, when the Committee asked to be continued.

The President.—The Chair will state that there was an entire misapprehension on the part of the Executive Committee with regard to Dr. Bracken's wishes, and would suggest that a motion is in order that the report of the Executive Committee be accepted and adopted with the exception as to the Committee on Leprosy, which will be continued.

Dr. Felix Formento.—I make a motion that the Committee be continued.

The motion was seconded.

The President.—The report of the Executive Committee, so far as it relates to the continuation of Standing Committees, is to be adopted, with the exception of the Committee on Leprosy, which is continued.

The motion was carried.

Mr. Crosby Gray, Secretary of the Advisory Council, then submitted the following report of the Advisory Council:

BUFFALO, September 19, 1901.

To the President and Members of the American Public Health Association:

LADIES AND GENTLEMEN: Your Advisory Council having performed the duties imposed upon it by the Constitution, begs to submit to your honorable body the following nominations for the various offices for the ensuing term, viz:

For President—Dr. Henry D. Holton, Brattleboro, Vt.

For First Vice President—Dr. Walter Reed, of U. S. Army.

For Second Vice President—Dr. Jésus Chico of Guanajuato, Mex.

For Treasurer—Dr. Frank W. Wright of New Haven, Conn.

Members of the Executive Committee (to serve for two years)—Dr. Gardner T. Swarts of Providence, R. I.; Dr. W. C. Gorgas of Havana, Cuba; Dr. J. C. Schrader of Iowa City, Ia.; (to serve for one year), Dr. Fernando Lopez of Mexico.

The Council submits the following nominations for officers of the Section of Bacteriology and Chemistry, the same having been selected by the members of that Section, viz:

For Chairman—Dr. F. F. Wesbrook of Minneapolis, Minn.

For Vice Chairman—Dr. H. L. Russell of Madison, Wis.

For Secretary—Mr. G. C. Whipple of Brooklyn, N. Y.

For Recording Secretary—Dr. H. D. Pease, New Haven, Conn.

For Members of the Council—Dr. W. H. Park of New York; Dr. M. J. Rosenau of Washington, D. C.; Dr. E. G. Horton of Columbus, O.; Dr. Angel Gaviño of Mexico, and the retiring Chairman; Dr. Wyatt Johnston of Montreal, *ex-officio*.

Your Advisory Council also recommends the city of New Orleans as the place in which to hold the next meeting of the Association.

Respectfully submitted,

CROSBY GRAY, Secretary.

It was moved by Professor Brewer that the report be accepted and adopted. Seconded and carried.

THE PRESIDENT.—The next business in order is the election of officers.

DR. J. I. GIBSON, Denison, Ia.—I move that the Secretary be instructed to cast the ballot of this Association for all the officers named in the report of the Advisory Council. Seconded and carried.

The Secretary then cast the ballot of the Association for the election of new members whose names had been read, and they were declared elected.

DR. J. I. GIBSON.—My motion was incomplete, in that it did not sanction New Orleans as being the place of the next meeting. I

move that the ballot of the Association be cast by the Secretary selecting New Orleans as the next place of meeting. Seconded and carried.

The Secretary then cast the ballot of the Association as directed.

Dr. A. L. Gihon of New York City.—I believe I am Chairman of the Committee on Resolutions on the late Dr. Horlbeck. It has been impossible to get the committee together. Every one here knows how highly Dr. Horlbeck was appreciated in the Association. It would be manifestly unjust to his memory for us to make any hasty attempt to do him justice. I therefore ask permission to prepare the report and hand it to the Secretary for incorporation in the next volume. Dr. Horlbeck has been a personal friend of mine for nearly thirty years. We have been associated together and I know his absolute worth and excellence, and if you will allow me I will record deliberately the expression of our regard for his memory.

It was moved and seconded that Dr. Gihon be given permission to prepare resolutions on the death of Dr. Horlbeck, as requested.

The next thing in order was the report of the Treasurer, which was read by Dr. Henry D. Holton of Brattleboro, Vt., as follows:

TREASURER'S REPORT.

Henry D. Holton, Treasurer, in account with the American Public Health Association:

1900.		Dr.
October 20	To cash on hand	$ 120 06
	To cash from dues of members for 1900	1,725 00
	To cash from dues of members for other years	175 00
	To cash from transactions sold	609 60
	To check returned from Wyatt Johnston's Committee	38 25
		$2,667 91

DISBURSEMENTS.

1900.		
November 9	Paid H. D. Holton, order No. 110	$ 565 58
November 10	Paid C. O. Probst, order No. 111	82 55
November 22	Paid H. D. Holton, order No. 112	76 55
1901.		
February 4	Paid William Whitford, order No. 113	186 00
May 8	Paid Berlin Printing Co., order No. 114	854 28
	Paid George C. Whipple, order No. 115	6 50
	Paid F. C. Robinson, order No. 116	6 00
August 31	Paid George W. Fuller, order No. 117	9 10
	Paid Berlin Printing Co., order No. 118	27 00
	Paid C. O. Probst, order No. 119	275 58
	Paid Henry D. Holton, order No. 120	132 05
	Paid Benjamin Lee, order No. 121	23 89
Cash on hand September 9, 1901		422 83
		$2,667 91

Certified correct and properly vouched for,
(Signed) P. H. Bryce.
S. H. Durgin.

It was moved and seconded that the report of the Treasurer be received and referred to an Auditing Committee. Carried.

Dr. Samuel H. Durgin of Boston, Mass., then reported on behalf of the Auditing Committee that the accounts of the Treasurer had been examined and found to be correct, and all bills properly vouched for.

It was moved and seconded that the Treasurer's report be accepted. Carried.

Dr. A. L. Gihon.—It would be proper for us to move a vote of thanks to the retiring Treasurer for the faithful and admirable manner in which the accounts of this Association have been kept for the last nine years.

The motion was seconded by Dr. Durgin and carried.

Dr. J. I. Gibson.—I move that at the next meeting we have a fixed program printed some time prior to the meeting. The making of the program during the night and springing it in the morning is not satisfactory. It seems to me that the program should be arranged in sections some time prior to the meeting, and if voluntary papers are presented have them added to the part of the program they naturally belong to. We could then have the discussion all at one time, after the reading of the papers. I move you, that we have at our next meeting the entire program to be presented to the members, at the first session.

The motion was seconded.

The Secretary.—The Executive Committee labored over the problem that Dr. Gibson brings up for an hour and a half. There is cause for complaint with the present arrangement, and yet there are difficulties in following the plan proposed. Not more than half of the papers are received by the Secretary prior to his getting to the place of meeting, and while I should very much prefer that your plan should be carried out, I doubt very much that it can be.

The President.—The Chair is in doubt whether a motion of this kind should not be referred to the Executive Committee.

Dr. J. I. Gibson.—I presume my motion is out of order, and if it is I withdraw it. If the motion is withdrawn, I request again of the Secretary and Executive Committee that the section work of the Association be outlined. If we cannot have the papers, say, we will have Tuberculosis up on a certain day and Yellow Fever another day and Smallpox another day.

THE SECRETARY.—I should be very glad, if the Association thinks it a wise rule, that no paper shall be read by the Association which is not in the hands of the Secretary, say twenty or thirty days before the time of the meeting.

Dr. U. O. B. Wingate of Milwaukee, Wis., then read the report of the Committee on Public Health Legislation. (See page 256.)

It was moved by Dr. Gihon that the report be accepted. Seconded and carried.

The report of the Committee on School Hygiene, on motion, was read by title, the Chairman, Dr. Henry Mitchell, of Trenton, N. J., being absent. (See page 260.)

The paper of Dr. Juan Breña of Zacatecas, Mex., entitled "Notes on the Necessity of Attending to the Hygiene of the Mouth Among Pupils of Schools," was then read by Dr. A. Gehrmann of Chicago, Ill. (See page 286.)

Dr. Frank W. Wright of New Haven, Conn., followed with a paper on "The Influence of School Life over Health." (See page 297.)

Dr. Ignacio Guzman of Mexico, Mex., contributed a paper on "Hygiene in Its Relation to the Primary School," which was read by Dr. Felix Formento of New Orleans, La. (See page 304.)

DISCUSSION OF THE PAPERS ON SCHOOL HYGIENE.

DR. HENRY J. BARNES, Boston, Mass.—It seems to me, from some school observation of late years, that the gross exaggeration of the deleterious influences of cold drafts is the cause of ill-ventilation of our school rooms, and that children are subject to infectious diseases from the closing of all doors and windows in the school room, public halls, railway trains and electric cars; that those are the factors which are breaking down our children, and not the long hours of study and work. Luxurious heating is another factor which debilitates and lowers the vitality and thus impairs the constitution.

DR. A. L. GIHON, New York City, N. Y.—As an Inspector of Public Schools, I can corroborate what the speaker has just said. The fault is usually with the teachers who wish to have the room too warm.

The report of the Committee on Demography and Statistics in Their Sanitary Relation, by Dr. John S. Fulton, Chairman, of Baltimore, Md., on motion, was read by title. (See page 305.)

The paper of Dr. Elias H. Bartley of Brooklyn, N. Y., entitled, "Some of the Causes of Infant Mortality in Nurseries and Asylums, and Their Prevention," on motion, was read by title. (See page 306.)

Dr. Adalberto Carriedo, Oaxaca, Mex., contributed a paper on "Sanatoria for Consumptives," which was also read by title. (See page 85.)

There being no discussion of the above papers, the paper of Dr. Luis G. Espinoza of Veracruz, Mex., entitled, "Cremation in Its Relation to Sanitary Legislation," was then read by the Secretary. (See page 314.)

The following statement was submitted, entitled, "Adoption by the Republic of Mexico of the Nomenclature of Diseases and Causes of Death, as approved by the International Conference, held in August, 1900."

"The International Nomenclature of Diseases and Causes of Death agreed to by the International Congress, held in Paris, in August, 1900, has been adopted by the Secretaries of Public Works, to whose charge is entrusted the statistics of the whole country, by the Federal District and by the Supreme Board of Public Health, and has been enforced since the first of January of this year. Nearly every one of the States of the Mexican Commonwealth has also adopted it.

"This statement is made on behalf of our Committee named in Mexico to examine the Bertillon Nomenclature, which has now an international character."

Dr. Eduardo Licéaga of Mexico, Mex., presented a paper entitled, "Summary of the Number of Anti-Rabic Inoculations made in the Institute which is maintained in Mexico by the Supreme Board of Health," which was then read by the Secretary. (See page 318.)

The retiring President, Dr. Lee, called upon Drs. Gihon and Formento to escort his successor, Dr. Henry D. Holton, to the chair, and congratulated the Association upon his election.

The President-elect, Dr. Holton, in taking the chair, said:

"In expressing to you the gratitude and the feeling I have of heart-felt thankfulness for this renewed demonstration of your confidence, I feel that the honor carries with it equal responsibilities. I feel my own weakness in attempting to fill the position, but I am sure that I can rely upon your aid and your support in carrying forward the work of this Association during the year upon which we are about to enter. The honor which goes with this office is superior to almost any other.

"Thanking you again for this honor and assuring you that I will put into this work the best effort possible, I bid you all a welcome to New Orleans next year."

On motion of Dr. Gihon, a vote of thanks was extended to the Local Committee for their kindly offices.

EX-PRESIDENT LEE.—I cannot permit my resignation to be recorded without expressing my sense of obligation to the Association for the leniency with which it has dealt with me during my occupancy of the chair. No one is more conscious than the Chair of the disabilities under which he labors in the performance of the duties of this office. He requests you, however, to remember that in addition to this he has been somewhat hampered by the very sad condition under which the Association has met this year. He claims the privilege of briefly referring to two or three features of this meeting. One is the presence for the first time of delegates from the colonial dependencies of the United States, a new territory which was represented by letter only, and of, we hope, a new republic. He also desires to call attention to the remarkable way in which the reports from the delegates from these new territories and possessions have sustained the position taken in the President's address, namely, that this new era which we signalize at this meeting will be the era of absolutism and the era of precision in sanitary administration the world over. As an illustration of absolutism, what could we have stronger and more convincing than the report from Porto Rico. The Secretary of that Board has powers such as are possessed by no monarch or despot in the world. As for precision, what could be more convincing and complete than the demonstrations which we have had from the Island of Cuba, possibly not yet complete, and yet so far as they go thoroughly convincing. We are breaking down every one of these enemies of public health, and the middle of this century will not be reached, I venture to predict, before every single infectious disease will be thoroughly understood, and its prevention secured at its point of origin.

The Secretary announced that a paper had been handed in by Dr. Lopez of Mexico, entitled, "Observation on the Practice of Disinfection in the Federal District of Mexico." (See page 253.)

It was moved and seconded that the paper be referred to the Publication Committee. Carried.

Dr. Felix Formento, New Orleans, La.—I move that a vote of thanks be tendered to our retiring President for the able, distinguished and impartial manner in which he has conducted this meeting.

The motion was seconded and carried.

As there was no further business to come before the Association, on motion, an adjournment was taken, to meet in the city of New Orleans, La., in the year 1902, the date to be determined by the Local and Executive Committees.

SECTION OF BACTERIOLOGY AND CHEMISTRY OF THE AMERICAN PUBLIC HEALTH ASSOCIATION.

REPORT OF COMMITTEE ON STANDARD METHODS OF WATER ANALYSIS.

SECOND REPORT OF PROGRESS.

In the first report of progress, read at the Indianapolis meeting a year ago, your committee gave as the result of its first step in the consideration of this problem a summary of the methods of water analysis now in use in America, based upon replies received to a circular letter sent to 125 leading analysts. From the evidence thus developed, and from personal correspondence with leading workers, it was apparent that the data were too meagre to put the committee in a position to present a set of standard procedures which would receive general support; and consequently no recommendations were made.

During the past year efforts have been made to secure a fuller expression of opinion upon certain portions of this line of work, and in a number of instances the committee has taken steps to facilitate matters through experimental work undertaken by analysts working in their individual capacity. These efforts have been so far successful that the committee is now able to make definite recommendations for the methods to be pursued in physical, microscopical and quantitative bacteriological examinations. These methods are given below.

Substantial progress has been made also in the investigation of certain methods of chemical analysis, and in qualitative bacteriological examinations, but sufficient data are not yet at hand to justify final action. In respect to the two latter portions of the problem, therefore, this report will be simply a record of current progress.

PHYSICAL EXAMINATION.

Temperature. The temperature shall be taken at the time of collection, and expressed, preferably, in centigrade degrees, to the nearest 0.5 degree or closer. For obtaining temperature of water at various depths the thermophone gives the most accurate results.

Turbidity. Three methods of measuring turbidity are in common use at the present time, namely, the Wire Method, the Diaphanometer Method and the use of Silica Standards of Comparison, each of which has its special field of application. For field-work, and especially for

use on turbid streams where a single daily observation suffices, the wire method is most convenient; for turbid waters in connection with purification works, the diaphanometer is most serviceable, while for general use with waters of comparatively low turbidity, the use of the silica standards seems desirable. While it may not be said that these methods have been perfected, yet in view of the importance of the turbidity problem, it seems desirable that, as far as possible, the observations by the various methods shall be made comparable with each other and given a uniform mode of expression. To this end it is recommended that the standard unit of turbidity shall be considered as that produced by one part per million of finely divided silica (prepared as described below) in distilled water; that the results of turbidity shall be expressed in parts per million of silica; and that the results obtained by the wire method and the diaphanometer method shall be reduced to their equivalents in parts per million of silica for purposes of report. Furthermore, in order that the turbidity may be conveniently compared with the weight of the suspended matter which produces it, it is suggested that the number obtained by dividing the weight of suspended matter in parts per million by the turbidity expressed in parts per million of silica shall be known as the "turbidity coefficient."

On this basis the turbidity coefficient would indicate the general character of the suspended matters. Water containing relatively large particles, which obviously increase the opacity of the water less than an equal weight of fine particles, would thus have a larger coefficient than water containing very fine particles. While considerable information along this line is available, it is insufficient to allow a further elaboration at this time. By way of illustration, however, it may be added that in the case of the Mississippi River water at New Orleans, which contains suspended particles varying widely in size, it has been found by Mr. Robert Spurr Weston that the turbidity coefficient ranges from .83 to 1.46 and averages 1.09. After this water has been subsided for 24, 48 and 72 hours, and the coarser particles removed thereby, the turbidity coefficient has been found to become on an average 0.80, 0.77 and 0.73 respectively. With less turbid waters it appears, in some cases at least, that the coefficient may be much smaller than at New Orleans.

A stock suspension of silica shall be prepared as follows: Diatomaceous earth, as free from amorphous silica and sponge spicules as may be obtained, is washed with water to free it from any soluble salts, and ignited to remove any organic matter. It is then treated

with warm dilute hydrochloric acid, and washed with successive portions of distilled water until free of acid. The material, now composed of practically pure diatomaceous frustules, is then ground to an impalpable powder in an agate mortar, sifted through a sieve that has 200 meshes to the inch, and dried in a dessicator. One gram of this prepared diatomaceous earth in 1 litre of distilled water gives the stock suspension, which has a turbidity of 1000, i. e., contains 1000 parts per million of silica

Standards for comparison shall be prepared from this stock suspension by dilution with distilled water. For turbidity readings below 20 standards of 0, 5, 10, 15 and 20 shall be kept in gallon bottles made of clear white glass; for reading above 20 standards of 20, 30, 40, 50, 60, 70, 80, 90 and 100 shall be kept in 100 cubic centimeter Nessler jars, approximately 20 millimeters in diameter.

Comparison of the water under examination with the standards shall be made by viewing them sidewise towards the light, looking at some object and noting the distinctness with which the margins of the object can be seen. The standards shall be kept stoppered, and both sample and standards shall be thoroughly shaken before making the comparison. In order to prevent any bacterial or algæ growths from appearing in the standards, a small amount of bichloride of mercury may be added to them.

At the present time it does not seem possible to prescribe rules for the use of wire method and the diaphanometer method save in the manner of expressing results, as recommended above. To this end, it is suggested that all forms of apparatus used shall be calibrated in terms of the silica standard under the conditions in which they are to be used, and that these graduations shall be used in place of the old method of expressing results in reciprocals of the depths in inches at which the wire or the cross of light in the diaphanometer disappears.

Color. The Platinum-cobalt Method of color measuring, as devised by Allen Hazen and described in the Am. Chem. Jour., Vol. XIV, No. 4, shall be considered as the standard, except that the unit of color shall be equal to the amount of platinum in parts per million, rather than in parts per 10,000, as originally proposed. The figures will be, accordingly, whole numbers instead of decimals reading to hundredths, as in Hazen's original method.

A standard solution which has a color of 500 shall be made by dissolving 1.246 grams of potassium-platinic chloride[1] ($PtCl_4$, 2 KCl),

[1] Potassium platinous chloride is a salt that is often substituted by dealers in place of the potassium platinic chloride. It is sometimes incorrectly labelled. The platinous salt has a reddish color, while the platinic salt has a yellow color.

containing 0.5 gram platinum, and 1 gram of crystalized cobalt chloride (Co Cl_2, 6 H_2 O), containing 0.25 gram of cobalt, in water, with 100 cubic centimeters of concentrated hydrochloric acid, and making up to one litre with distilled water. By diluting this solution, standards shall be prepared having colors of 0, 5, 10, 15, 20, 25, 30, 35, 40, 50, 60 and 70. These shall be kept in 100 cubic centimeter Nessler jars of such diameter that the liquid shall have a depth between 20 and 25 centimeters, and shall be protected from dust. The color of a sample shall be observed by filling a similar tube with the water and comparing it with the standards. The observation shall be made by looking vertically downwards through the tubes upon a white surface placed at such an angle that light is reflected upwards through the column of liquid. The reading shall be recorded to the nearest unit. Waters that have a color darker than 70 shall be diluted before making the comparison, in order that no difficulty may be encountered in matching the hues. Water containing matter in suspension shall be filtered until no visible turbidity remains. If the suspended matter is coarse, filter paper may be used for this purpose; if the suspended matter is fine, the use of the Berkefeld filter is recommended. The use of a Pasteur filter is to be avoided, as it exerts a slight decolorizing action.

Odor. The odor of the sample shall be observed both hot and cold, and the most characteristic of these odors shall be recorded according to the following method expressive of the quality and intensity of the odor.

Quality of the Odor. This shall be expressed by some such descriptive epithet as the following, which for purposes of record may be abbreviated:

v—vegetable.	*m*—moldy.
a—aromatic.	*M*—musty.
g—grassy.	*d*—disagreeable.
f—fishy.	*p*—peaty.
e—earthy.	*s*—sweetish.

etc.

Intensity of the Odor. This shall be expressed by a numeral prefixed to the term expressing quality, which may be defined as follows:

NUMERICAL VALUE.	TERM.	APPROXIMATE DEFINITION.
0	None.	No odor perceptible.
1	Very Faint.	An odor that would not be ordinarly detected by the average consumer, but that could be detected in the laboratory by an experienced observer.
2	Faint.	An odor that the consumer might detect if his attention were called to it, but that would not otherwise attract attention.
3	Distinct.	An odor that would be readily detected and that might cause the water to be regarded with disfavor.
4	Decided.	An odor that would force itself upon the attention and that might make the water unpalatable.
5	Very Strong.	An odor of such intensity that the water would be absolutely unfit to drink, (A term to be used only in extreme cases).

MICROSCOPICAL EXAMINATION.

The modified Sedgwick-Rafter Method of microscopical examination, as described in Whipple's "Microscopy of Drinking Water," is recommended for general use. The results shall be expressed in "Number of Standard Units per Cubic Centimeter."

QUALITATIVE BACTERIOLOGICAL EXAMINATIONS.

Following the inquiry as to the general status of this subject, it was thought best to ascertain to what extent the present methods for species determination, as used in various laboratories, are comparable with

each other. Through the kind co-operation of many of the members of this Section, this was tested in a practical manner. Two species of bacteria were selected from a sample of water, and pure cultures on agar were mailed on the same date to about thirty bacteriologists, with the request that each one study them according to his customary methods and report the results without giving his name. The species were selected at random, save that one was chosen as being a non-liquefying, gas-producing form, and the other as possessing the opposite characteristics in these respects. Strangely enough, the sequel showed that both were apparently undescribed species. Seventeen sets of results were returned to the committee. These were collated, and blueprint copies sent to each one who had participated in the work, in order to secure a better understanding of the data and the individual conditions associated therewith. In the final report of the committee it is intended to publish them for the benefit of the Section. The results of these comparative studies are of considerable interest, and indicate quite clearly that much assistance can be expected from a continuance of such studies. In a general way the present data are fairly comparable, but in certain tests, as in the coagulation of milk, the production of indol, the production of nitrates and gas production, there were found differences which indicate variations in laboratory procedures. With regard to the morphological characteristics, it may be said in passing that the agreement among the several workers was very striking. For the most part it was found that the methods recommended by the Bacteriological Committee of 1897 were in use.

It is proposed to repeat this work during the coming year by sending out two more unknown cultures, with the request that the methods recommended by the Bacteriological Committee of 1897 be followed rigidly, in order to determine the differences due to manipulation, as distinguished from those due to variations in method. Already a large number of workers have expressed their willingness to co-operate in these comparative studies, and the committee feels that in due time these laborious and time-consuming investigations will yield data indicative of improvements over the methods currently practiced.

QUANTITATIVE BACTERIOLOGICAL EXAMINATIONS.

In order to secure more detailed and more definite information than was available from the replies received to the circular letter issued last year, a second letter, containing a list of twenty-four questions bearing upon the details of the process, was sent out. About forty replies were received, representing the views of very nearly all of the laboratories in which most attention is given to this class of analytical work.

The questions embodied in the second circular letter, with a summary of the answers which were received, together with a list of those who returned replies, are given as an appendix to this report.

With regard to the unanimity of opinion expressed in this correspondence, it is to be said that the evidence on the whole is gratifying in this respect. If we make exception of a few special points, such as the elimination and addition of sugar to the culture medium, about which data are very meagre, it is found that the proportion of analysts dissenting from the views of the majority is quite small. It seems, at least in some instances, that the differences of opinion are explained by differences in conditions associated with the studies of the workers. Without doubt, conditions are to be found wherein the numbers of bacteria might be better determined by special procedures, rather than by those which most commend themselves to the majority of workers both in this country and abroad. Your committee is not unmindful of this condition of affairs, and in no sense desires to take a position which would seem to discourage thorough studies as to improvements for special conditions.

As all quantitative examinations of bacteria can yield only relative, and not absolute, results, it seems clear enough that the great gain to be obtained by putting on a strictly comparable basis the data secured at a large number of laboratories, not only in this country but abroad, far more than outweighs the sacrifices made in the scattering instances of special conditions. Wherever special procedures seem advisable, after careful study, the differences between the methods actually used and the standard procedures should be recorded without fail.

Taking the best available evidence as the basis, including the replies to the circular letter, as well as opinions and data personally expressed, your committee has formulated the following standard procedures for the quantitative bacteriological examination of water:

OUTLINE OF STANDARD METHODS FOR THE QUANTITATIVE BACTERIOLOGICAL EXAMINATION OF WATER.

Samples. Collection bottles shall have a capacity of at least four ounces, and shall have wide mouths and glass stoppers. Before use they shall be cleaned with sulphuric acid and potassium bichromate (or with alkaline permanganate of potash, followed by sulphuric acid), rinsed until free of acid, drained and sterilized with dry heat for one hour at 160 deg. C., or in an autoclav at 115 deg. C. for fifteen minutes. For transportation they shall be wrapped in sterilized cloth, or the necks and stoppers protected with tin-foil or some substitute, and the bottles enclosed in a tin box. If the sample is not plated at the time of collection, the temperature of the sample shall be maintained

between 0 deg. and 10 deg. C. during the interval. If this temperature is maintained, the following approximate intervals between the time of collection and the time of plating may ordinarily be considered safe. Relatively pure water, 12 hours; relatively impure water, 6 hours; sewage, 1 hour. It is recommended, however, that the interval between the time of collection and the time of plating be stated in the report.

Culture Media. Sterilized nutrient gelatine prepared as described below shall be considered as the standard culture medium for the quantitative bacteriological examination of water, except for field work and in the case of sewage and highly polluted streams, when standard agar may be substituted. All variations from these two media shall be considered as special media. For general work, a reaction of + 1.0 should be used, but for long-continued work upon water from the same source the optimum reaction should be ascertained by experiment and thereafter adhered to.

STANDARD METHOD FOR MAKING NUTRIENT GELATINE AND NUTRIENT AGAR, FOR QUANTITATIVE BACTERIOLOGICAL EXAMINATIONS OF WATER.

	GELATIN.	AGAR.
1.		Boil 15 g. thread agar in 500 c. c. water for half an hour and make up weight to 500 g. or digest for 10 minutes in the autoclav at 110° C. Let this cool to about 60° C.
2.	Infuse 500 g. lean meat 24 hours with 1000 c. c. of distilled water in refrigerator.	Infuse 500 g. lean meat 24 hours with 500 c. c. of distilled water in refrigerator.
3.	Make up any loss by evaporation.	
4.	Strain infusion through cotton flannel.	
5.	Weigh filtered infusion.	
6.	Add 1% Witte's peptone and 10% gold label sheet gelatin.	Add 2% of Witte's peptone.
7.	Warm on water bath, stirring till peptone and gelatine are dissolved and not allowing the temperature to rise above 60° c.	
8.	Neutralize.	
9.		To 500 g. of the meat infusion add 500 c. c. of the 3% agar, keeping the temperature below 60° c.
10.	Heat over boiling water (or steam) bath 30 minutes.	
11.	Restore loss by evaporation.	
12.	Titrate, after boiling one minute to expel carbonic acid.	
13.	Adjust reaction to + 1.0% by adding normal hydrochloric acid or sodium hydrate as required.	

	GELATIN.	AGAR.
14.	Boil two to five minutes over free flame, constantly stirring.	
15.	Make up loss by evaporation.	
16.	Filter through absorbent cotton and cotton flannel, passing the filtrate through the filter until clear.	
17.	Titrate and record the final reaction.	
18.	Tube, using 5 c. c. in each tube in the case of gelatin, and 7 c. c. in the case of agar.	
19.	Sterilize 15 minutes in the autoclav at 110°, or for 30 minutes in streaming steam on three successive days.	
20.	Store in the ice-chest in a moist atmosphere, to prevent evaporation.	

Method of Plating. The bottle which contains the sample shall be shaken at least twenty-five times, after which one cubic centimeter shall be withdrawn with a sterilized one c. c. pipette, and delivered into a sterilized Petri dish (10 centimeters in diameter). If there is reason to suspect that the numbers of bacteria will be more than 200 per cubic centimeter, one centimeter of the sample shall be first mixed with nine cubic centimeters of sterilized tap water, or distilled water, and after shaking at least twenty-five times, one cubic centimeter of the diluted sample shall be measured into a Petri dish. If higher dilutions are required they shall be successively made in the same manner. To the liquid in the dish, 5 c. c. of standard 10 per cent. gelatine at a temperature of about 30 deg. C. shall then be added, and the dish tipped back and forth until a thorough mixture has taken place and the contents equally spread over the bottom of the plate. Or, the sample may be mixed with the gelatine in the tube and afterwards poured into the plate. The gelatine after mixture with the sample should be allowed to cool rapidly on a horizontal surface, and transferred to the incubator as soon as it is hard; or, if the shelves of the incubator are perfectly level, the plates may be placed at once in the incubator. If agar is employed instead of gelatine the quantity used shall be 7 c. c. and its temperature shall be approximately 40 deg. C.

Incubation. Incubation should take place in a dark, well ventilated chamber where the temperature is kept substantially constant at 20 deg. C., and where the atmosphere is practically saturated with moisture. Proper atmospheric conditions with respect to oxygen and moisture may be obtained by the use of a ventilated dish and an incubator in which a shallow pan of water is placed in the chamber. The standard period of incubation shall be forty-eight hours. If for any reason a longer period is used, that fact shall be so stated in the records.

Counting. So far as practicable the number of bacteria upon the plate shall not be allowed to exceed 200. Counting shall be done with the aid of a lens which magnifies about five diameters, and of a glass plate suitably ruled. The whole number of bacteria on the plate shall be counted, and the practice of counting a fractional part resorted to only in case of necessity.

Expression of Results. In order to limit fictitious accuracy and yet to express the numerical results by a method consistent with the precision of the work, the following mode of expression shall be followed:

Numbers of Bacteria from 1 to	50	shall be recorded to the nearest unit.
51	100	5
101	250	10
251	500	25
501	1,000	50
1,001	10,000	100
10,001	50,000	500
50,001	100,000	1,000
100,001	500,000	10,000
500,001	1,000,000	50,000
1,000,001	5,000,000	100,000

(Signed) GEORGE W. FULLER,
New York, N. Y., Chairman.
GEORGE C. WHIPPLE,
Brooklyn, N. Y., Secretary.
HARRY W. CLARK,
Boston, Mass.
ADOLPH GEHRMANN, M. D.,
Chicago, Ill.
WYATT JOHNSTON, M. D.,
Montreal, P. Q.
E. O. JORDAN, PH. D.,
Chicago, Ill.
H. L. RUSSELL, PH. D.,
Madison, Wis.

APPENDIX I.

LIST OF QUESTIONS SENT OUT WITH CIRCULAR LETTER AND SUMMARY OF THE REPLIES FROM THIRTY-NINE BACTERIOLOGISTS.

1. In view of the very small amount of mineral and organic matter in the great majority of public water supplies, do you consider it permissible to use tap water containing no appreciable amount of suspended matter, and not more than 150 parts per million of dissolved residue on evaporation, in place of distilled water in the preparation of culture media for quantitative work? Yes, 29. No, 9. No opinion, 1.

2. In view of the fact that meat extract has been found from time to time to have an inimical effect upon bacteria, do you consider it advisable to prepare media exclusively from meat infusion, as is the official procedure in Germany? Yes, 33. No, 2. No opinion, 4.

3. Do you consider that it would be advisable to remove all muscle sugar, if such is present, from the meat extract or meat infusion, whichever is used? Yes, 19. No, 13. No opinion, 7.

4. Do you consider that it would be advantageous to add a fixed quantity of carbohydrate to the culture of medium? Yes, 12. No, 11. No opinion, 16.

5. Is it your opinion that the addition to the medium of peptone equal in quality to that made by Witte and to the amount of 1 per cent. by weight should be adopted as an official procedure, as is the almost universal practice? Yes, 35. No, 0. No opinion, 4.

6. In view of the circumstance that the addition of salt to the amount of 0.5 per cent. was apparently due, in the early days of bacteriology, to its assistance in dissolving peptone of inferior quality to that now on the market, and the indications that salt complicates rather than simplifies and improves the composition of the medium, are you in favor of its omission, notwithstanding its general use? Yes, 27. No, 5. No opinion, 7.

7. From the prevailing evidence that the omission of either meat infusion or peptone, or both, or the substitution of "new" ingredients for one or both of the same, give very inconsistent results in the hands of different workers, and as a rule in the hands of the same worker, are you in favor of regarding such modified procedures at present as *special* media, and not regular or official media? Yes, 34. No, 1. No opinion, 4.

8. Are you satisfied with the prevailing view that for the present the solidifying ingredient for quantitative culture medium had best be gelatine, of the highest quality of the market? Yes, 35. No, 3. No opinion, 1.

9. Do you believe that it would be advantageous to prepare media with 12 rather than 10 per cent. of gelatine? Yes, 21. No, 10. No opinion, 8.

10. Are you in favor of recognizing as permissible and consistent with good standard practice, the substitution of agar for gelatine in examinations of crude sewages and in field work relative to highly-polluted streams? Yes, 21. No, 1. No opinion, 10.

11. Are you in favor of Hill's method of preparation of gelatine as a standard procedure? Yes, 21. No, 1. No opinion, 18.

12. Are you in favor of Ravenel's methods of preparation of agar as a standard procedure? Yes, 23. No, 2. No opinion, 14.

13. Do you approve of the prevailing view that, for continuous work on water from the same source, the optimum reaction of the nutrient medium should be actually determined and thereafter regularly adopted? Yes, 26. No, 3. No opinion, 10.

14. In the case of casual or scattering examinations of surface waters, are you in favor of using a reaction of +1.0 in the absence of any specific data relative to the optimum? Yes, 25. No, 6. No opinion, 8.

15. In the case of ground waters, would you approve under such circumstances of a reaction of 0? Yes, 7. No, 6. No opinion, 26.

16. In view of the fact that the use of 5 c. c. of gelatine for a plate of 10 centimeters in diameter conduces to more rapid development of the colonies than a larger quantity, are you in favor of 5 c. c. as a standard quantity? Yes, 32. No, 5. No opinion, 2.

17. Are you satisfied that 25 vigorous shakes of the partially-filled sample bottle insures, to a reasonable degree, thorough mixing of the water and separation of groups of bacteria? Yes, 25. No, 6. No opinion, 8.

18. Are you in favor of arranging so far as practicable to have not more than about 200 bacteria on a plate of ordinary size, say, 10 centimeters in diameter? Yes, 38. No, 0. No opinion, 1.

19. In case of waters high in numbers of bacteria, are you in favor of diluting the sample with sterilized water as compared with the use of pipettes delivering small fraction of 1 c. c? Yes, 33. No, 3. No opinion, 3.

20. In view of the fact that the growing custom of mixing the water and the gelatine in the plate, rather than in the tube, conduces to greater precision, are you in favor of its adoption as a standard procedure, notwithstanding the fact that the available evidence does not show that it affects the result beyond the ordinary limits of accuracy, and that it obligates the use of the Petri dish or similar device? Yes, 20. No, 13. No opinion, 6.

21. Are you in favor of the adoption, as standard procedures, of the prevailing custom of cultivating bacteria, for quantitative work, in the dark, and in an atmosphere in which oxygen and moisture are always present? Yes, 37. No, 0. No opinion, 2.

22. Is it your opinion that the custom of cultivating bacteria at a constant temperature of 20 degrees C should be made a standard procedure? Yes, 36. No, 1. No opinion, 2.

23. In view of the fact that the value of numbers of bacteria in a water depends upon their relative, and not upon their absolute, results, and the further fact that short-period counts have greater practical value than long-period counts in the application to the great majority of actual water supply problems, are you in favor of the adoption as a standard procedure of the custom of making the final count at the end of 48 hours' cultivation at 20 degrees C, as is the official German practice? Yes, 24. No, 10. No opinion, 5.

24. With the view to the elimination of gross evidence of fictitious accuracy, and to establishing greater confidence in quantitative bacterial results in the minds of those who are accustomed to regarding figures in their true mathematical relationship, are you in favor of the

adoption as a standard method of reading results, of the following scheme:

Number of Bacteria.	*Recorded To.*
1—50	Nearest Unit.
51—100	" five.
101—250	" ten.
251—500	" twenty-five.
501—1,000	" fifty.
1,001—10,000	" hundred.
10,001—50,000	" five hundred.
50,001—100,000	" thousand.
100,001—500,000	" ten thousand.
500,001—1,000,000	" fifty thousand.
1,000,001—5,000,000	" hundred thousand.

Yes, 37. No, 0. No opinion, 2.

APPENDIX II.

BACTERIOLOGISTS WHOSE REPLIES ARE INCORPORATED IN THE LIST OF REPLIES TO THE CIRCULAR LETTER.

ABBOTT, DR. A. C.,
Professor of Hygiene and Bacteriology, University of Pennsylvania, Philadelphia, Pa.

AMYOT, MR. J. A.,
Bacteriologist, Provincial Board of Health, Toronto, Ontario.

BISSELL, DR. WILLIAM G.,
Bacteriologist, Department of Health, Buffalo, N. Y.

CAIRD, MR. J. M.,
Bacteriologist, 52 Pawling Ave., Troy, N. Y.

CLARK, H. W.,
Chemist, Massachusetts State Board of Health, State House, Boston, Mass.

CONNELLY, DR. R. N.,
City Bacteriologist, City Hospital, Newark, N. J.

COPELAND, MR. WILLIAM R.,
Biologist, Testing Station, Bureau of Surveys, Philadelphia, Pa.

ERNST, DR. H. C.,
Professor of Bacteriology, Harvard University, Cambridge, Mass.

FULLER, MR. GEORGE W.,
Private Practice, 100 William St., New York City.

GAGE, STEPHEN DEM.,
Experiment Station, Massachusetts State Board of Health, Lawrence, Mass.

GORHAM, DR. L. P.,
Bacteriologist, Health Department, Providence, R. I.

HILL, DR. H. W.,
Director, Boston Board of Health Laboratory, Boston, Mass.

HISS, DR. P. H.,
Instructor in Bacteriology, College of Physicians and Surgeons, Columbia University, New York City.

HORTON, MR. E. G.,
Bacteriologist, Ohio State Board of Health, Columbus, O.

JOHNSON, MR. G. A.,
Bacteriologist, 100 William St., New York City.

JOHNSTON, DR. WYATT,
Bacteriologist, Board of Health, Province of Quebec, Montreal, Que.

JORDAN, PROF. E. O.,
Associate Professor of Bacteriology, University of Chicago, Chicago, Ill.

KINNICUTT, DR. L. P.,
Director Chemical Laboratory, Worcester Polytechnic Institute Laboratory, Worcester, Mass.

KNOWLES, MR. MORRIS,
Resident Engineer, Bureau of Filtration, Pittsburg, Pa.

LEAL, DR. J. L.,
Sanitary Advisor, E. Jersey Water Company, Paterson, N. J.

LEFFMANN, PROF. HENRY,
Professor of Chemistry, Woman's Medical College, Philadelphia, Pa.

MASON, PROF. WILLIAM P.,
Professor of Chemistry, Polytechnic Institute, Troy, N. Y.

MOORE, PROF. V. A.,
Professor Comp. Pathology and Bacteriology, N. Y. State Veterinary College, Ithaca, N. Y.

NOVY, PROF. F. G.,
Professor of Hygiene, University of Michigan, Ann Arbor, Mich.

PARKER, MR. H. W.,
Board of Health, Montclair, N. J.

PEASE, DR. H. D.,
Director of Antitoxin Laboratory, New York State Department of Health, Albany, N. Y.

PRESCOTT, MR. S. C., and
WINSLOW, MR. C. E. A.,
Instructors in Bacteriology, Massachusetts Institute of Technology, Boston, Mass.

RAVENEL, DR. M. P.,
Bacteriologist, State Live Stock Sanitary Board of Pennsylvania, Philadelphia, Pa.

RUSSELL, PROF. H. L.,
Professor of Bacteriology, University of Wisconsin, Madison, Wis.

DE SCHWEINITZ, DR. E. A.,
Director, Biochemical Laboratory, Department of Agriculture, Washington, D. C.

SMITH, PROF. E. G.,
Director of Sanitary Laboratory, Beloit College, Beloit, Wis.

SMITH, DR. THEOBALD,
Pathologist, State Board of Health, Forest Hills, Mass.

SOPER, DR. G. A.,
Private Practice, 29 Broadway, New York City.

STOKES, DR. WILLIAM R.,
Bacteriologist, State Board of Health, Baltimore, Md.

STONE, DR. B. H.,
Bacteriologist, State Laboratory of Hygiene, Burlington, Vt.

WACHTER, MR. L. M.,
Assistant Bacteriologist, Bender Hygienic Laboratory, Albany, N. Y.

WESBROOK, DR. F. F.,
Professor of Bacteriology and Pathology, University of Minnesota; Director, Bacteriological Laboratory, State Board of Health, Minneapolis, Minn.

WESTON, MR. R. S.,
Resident Expert, Sewerage and Water Board, 602 Carondelet St., New Orleans, La.

WILSON, DR. E. H.,
Director, Hoagland Laboratory, Brooklyn, N. Y.

WHIPPLE, MR. G. C.,
Director, Mt. Prospect Laboratory, Brooklyn, N. Y.

STUDIES OF MEDIA FOR THE QUANTITATIVE ESTIMATION OF BACTERIA IN WATER AND SEWAGE.

By STEPHEN DeM. GAGE,
Biologist at the Lawrence Experiment Station, and
EARLE B. PHELPS.

It is a well-known and accepted fact among bacteriologists that in a quantitative determination of the bacteria in water, we count only a small percentage of the total number of the bacteria present in that water. This is evident when we consider the large number of nitrifying bacteria of Winogradski, and the many species of pathogens and anærobes, which do not develop on our ordinary media under the usual conditions of quantitative work. It has, however, always been tacitly assumed that all results obtained on a medium of standard composition were comparable, or in other words, that these results, while not representing the total number of bacteria present, do give us a certain fairly constant percentage of this total.

If such is the case, a medium of standard composition, and one which can be readily duplicated at any time, has all the requirements of a perfect medium.

The composition of the media in general use today is so complex that it is almost impossible to make any two lots of nutrient gelatine or agar exactly the same, and it is only by the most painstaking regard for minute details that we are able to get quantitative results which are in any way comparable.

Experiments by Fuller (1) and others have shown that changes in the final reaction of a medium produce considerable changes in the numbers of bacteria developing on that medium, and Sedgwick and Prescott (2) have shown that small variations in the amount of ingredients or the use of different brands of commercial gelatine cause considerable variation in the bacterial counts.

Later experiments by Hesse and Nieder (3) show that it is possible to produce a medium, more simple in composition than the usual nutrient gelatine, which will give largely increased counts of bacteria on any given water, over those shown by the ordinary methods. In the following paper, the authors propose to show comparatively, the variation produced by various changes in the composition of culture media, and that a simplification of the usual media will produce increased bacterial counts.

METHOD OF EXPRESSING RESULTS.

All of the results of our experiments have been expressed as percentages of the highest count on any medium in the series. In all tables containing Nahrstoff-agar, each medium has been compared directly with this agar, it being found to be the one giving the highest counts, and also with each other medium in the table.

In every case the figures given are the average of at least four separate comparisons with the different classes of waters indicated. It is often the case that counts on a medium become obscured by reason of liquefaction or spreaders. In our tabulations we have not included any counts on days after the maximum was reached, but have carried out this maximum as the number which would be found on each of the succeeding days. This method of tabulation is, we think, more accurate, as the ratio of reduction, after the maximum is reached, appears to be an individual one for each plate and we have never been able to trace any connection in this respect between any two plates or any two classes of water.

COMPOSITION AND PREPARATION OF MEDIA.

Preparation. With the exception of that containing Nahrstoff-Heyden, all media has been prepared according to the procedure described by Fuller and Copeland in the '95 report of the Massachusetts Board of Health.

Media containing Nahrstoff was prepared according to the above procedure except that the solutions were made neutral before the addition of the Nahrstoff. This was necessary, as the addition of either acid or alkali causes a change and consequent precipitation in the Nahrstoff, which experiment showed to be detrimental to the numbers of bacteria developing.

Reaction. All media not containing Nahrstoff has had a uniform acidity of 1.5 per cent., this reaction being the one most favorable for use with Lawrence waters. Media containing Nahrstoff has been neutral to phenolphthalein.

Composition. The composition of the different media used was as follows:

Regular-agar (as used in routine work at Lawrence), 1 per cent. agar, 1 per cent. pepton, 3 per cent. glycerine, in beef-broth.

Plain-agar, 1 per cent. agar in water.

Pepton-agar, 1 per cent. agar, 1 per cent. pepton, in water.

Meat-agar, 1 per cent. agar, in beef-broth.

Standard-gelatine, 12 per cent. gelatine, 1 per cent. pepton, 0.5 per cent. salt, in beef-broth.

Plain-gelatine, 12 per cent. gelatine, in water.

Pepton-gelatine, 12 per cent. gelatine, 1 per cent. pepton, in water.

Meat-gelatine, 12 per cent. gelatine, in beef-broth.

Nahrstoff-agar, 1 per cent. agar, 1 per cent. Nahrstoff, in water.

Nahrstoff-pepton-agar, 1 per cent. agar, 1 per cent. Nahrstoff, 1 per cent. pepton, in water.

Nahrstoff-meat-agar, 1 per cent. agar, 1 per cent. Nahrstoff, in beef-broth.

Nahrstoff-glycerine-agar, 1 per cent. agar, 1 per cent. Nahrstoff, 3 per cent. glycerine, in water.

Nahrstoff-gelatine, 12 per cent. gelatine, 1 per cent. Nahrstoff, in water.

All of the ingredients used in the above media, including the beef-broth, were from the same lot, thus eliminating variations due to difference in the components.

EFFECT OF VARIATION IN THE AMOUNT OF NUTRIENTS.

In order to show the effect of varying the amount of nutrition present in the usual agar and gelatine, both of these media were made up in three strengths, one containing the usual amount, one one-half the usual amount, and one twice the usual amount of pepton and beef-broth. The following figures will show the relative numbers of bacteria obtained on these media:

Per cent. of usual amount of pepton and broth..	50	100	200
Gelatine	56	95	72
Agar	39	100	78

From these it appears that the relative difference is less for gelatine than for agar. It should be noted that the results on agar were higher than those on gelatine. This is not unusual, although the average of a long series of comparisons of the two generally show the gelatine to be slightly the better.

EFFECT OF VARYING THE STIFFNESS.

It has generally been considered that the reason that gelatine plates give the higher counts is partly due to the difference in stiffness of the two media. This being the case, various observers have tried mixing

the two in different proportions in an attempt to find a medium combining the good points of each.

Along this line we have succeeded in obtaining a medium which is somewhat better than either the gelatine or agar alone, but the increased difficulty of preparation makes it doubtful whether the results are worth the trouble. This medium is a mixture of the usual nutrient gelatine and agar in the proportion of one of agar to three of gelatine. Media of this description gave somewhat higher average counts than either gelatine or agar alone and had the advantage of not being troubled by spreaders, and the liquefaction was checked just enough to allow good counts on the fourth day. Furthermore, the cultural characteristics of the different species appear to be well marked, although the liquefaction does not progress at such a rapid rate. It should be noted, however, that the percentage constancy with different classes of waters is not very good.

In the following table are shown the results of cultures on mixtures of gelatine and agar.

Per cent. of Agar	0	5	25	50	75	95	100
Per cent. of Gelatine	100	95	75	50	25	5	0
Sewage	94	82	100	63	71	66	56
Filtered sewage	100	79	85	66	78	67	54
Merrimack River	82	80	100	43	70	70	54
Filtered water	75	73	71	66	64	61	100
Total	98	88	100	67	79	74	79

EFFECT OF DIFFERENCE IN COMPOSITION OF MEDIA.

In order to test the effect of various changs in the composition of media, we have studied eleven different media besides our regular gelatine and agar. As a result of these studies we find that by a reduction of the number of the usual components of our plate media, we are able to obtain media which give considerably higher counts. Unfortunately, however, it is not the same ingredient which should be omitted from both gelatine and agar in order to get the highest count on each. By omitting pepton from the gelatine we get the best results, while the omission of the meat-broth gives the best results for agar. By

cutting out the pepton or both pepton and beef-broth from agar and by omitting the beef-broth from the gelatine we get a medium giving higher results than either the standard-gelatine or the regular-agar.

Salt has only been added to the usual media to increase the solubility of the pepton. The authors have never experienced any difficulty in dissolving pepton in beef-broth or in water, without the addition of salt, and the evidence of all investigators has been to the fact that the omission of salt results in a better medium. It has been the practice at Lawrence for some years to omit the salt from the agar, although its use has been continued in the gelatine for the sake of conformity to the practice in other laboratories.

In comparison with media made of the usual ingredients, even after such improvements in composition as we have shown to be of advantage, agar made by the simple addition of Nahrstoff-Heyden to boiling water and filtering, tubing and sterilizing as soon as dissolved, shows increased counts over our regular media which are rather astonishing when viewed from our usual standpoint.

The addition of any of our usual nutrients in conjunction with this substance proves to be a detriment rather than an improvement.

This medium points toward the solution of the problem of a standard medium for quantitative work, or at least toward a medium, against which we may check our usual media.

The tendency of general public health work today is toward a medium which will enable us to shorten the time of incubation necessary to give an opinion on the purity of a water. The maximum count on this medium is, however, beyond even our present limit of four days. On the other hand, we get results with it on the second day, which are better than the best of those on our regular media in three or four days. With regard to this point of two-day counts, we would also call attention to the similarity of the two-day counts on the pepton-agar and the meat-gelatine with the four-day counts on standard-gelatine. In the following table are shown the results of daily counts on the various media:

TABLE SHOWING PERCENTAGES OF BACTERIA DEVELOPING ON MEDIA OF DIFFERENT COMPOSITIONS.

Medium.	Days count:							
	2.	3.	4.	5.	6.	7.	8.	9.
Nahrstoff-agar	19	60	78	85	95	99	99	100
Nahrstoff-pepton-agar	10	22	26	28	30	30	30	30
Pepton-agar	11	16	22	23	24	24	24	24
Meat-agar	8	13	16	17	17	17	17	17
Plain-agar	8	10	13	14	14	14	14	14
Regular-agar	7	9	11	11	11	11	11	11
Nahrstoff-glycerin-agar	6	10	11	11	11	11	11	11
Nahrstoff-meat-agar	7	7	8	8	10	10	10	10
Meat-gelatine	12	19	24	26	26	26	26	26
Pepton-gelatine	7	12	18	20	20	20	20	20
Standard-gelatine	8	10	11	12	13	13	13	13
Plain-gelatine	1	6	12	13	13	13	13	13
Nahrstoff-gelatine	5	6	9	11	13	13	13	13

CONSTANCY WITH DIFFERENT CLASSES OF WATERS.

To show the difference in counts with different waters we have tabulated separately some of the results embodied in the foregoing table. As, however, a table including all of the media studied would be too long for insertion here, we have included only the results on our regular-agar as compared with the Nahrstoff-agar.

In this table it is noticed that the increase in numbers on the new medium varies from about sixteen times for a pure ground water to less than two times for a sewage. By comparing other media we have found that the ratio is quite different for the different media, some giving the ground water the highest per cent., others filtered water, etc. In every case, however, the Nahrstoff-agar shows more colonies than any other medium.

The following table shows the irregularity in the proportion of bacteria developing on the regular-agar as compared with the Nahrstoff-agar.

TABLE SHOWING PERCENTAGES OF BACTERIA DEVELOPING ON REGULAR-AGAR AND ON NAHRSTOFF-AGAR FOR DIFFERENT CLASSES OF WATERS.

Class of Water.	Days count.						
	2.	3.	4.	5.	6.	7.	8.
Regular-agar.							
Ground Water	0	5	6	6	6	6	6
Filtered Water	6	7	7	7	7	7	7
Merrimack River	6	7	7	8	8	9	9
Filtered Sewage	14	17	18	19	19	19	19
Sewage	34	44	46	46	46	46	46
Nahrstoff-agar.							
Ground Water	6	43	78	88	93	100	100
Filtered Water	37	69	80	92	98	100	100
Merrimack River	29	78	93	97	97	99	100
Sewage, Filtered	26	65	93	95	97	99	100
Sewage	39	75	95	100	100	100	100

CONCLUSION.

From the tabulated results it appears to us that the Nahrstoff-agar has advantages over all the other media we have studied, for all-round quantitative work. For all classes of waters which have come within our notice, we have found that it gives counts of bacteria which are larger, and hence nearer to the actual bacterial contents of the water, than any other medium known to us.

Nahrstoff-Heyden is, we understand, a pure albumose made from egg albumen, and while of somewhat complex composition, it is not as likely to vary as are our usual beef-broth, pepton and gelatine.

This is a distinct advantage as enabling us to prepare a medium of uniform composition, thus making the results obtained in different laboratories comparable.

As to the reason why the counts are so much higher on this medium, we have been unable to come to any definite conclusion.

Muller, (4) in his studies on this line, comes to the conclusion that the increase is due to the fact that certain species of bacteria, which do not grow on the usual media, do flourish on this medium. In this point the authors concur with him, but we are also led to believe that many debilitated individual bacteria, which have not the vitality to produce colonies on the usual media, are able to develop slowly on this medium. This would, in a measure, account for the length of time required to reach a maximum count. From studies now in progress, we hope to be able to throw more light on this point in the near future.

In concluding, the authors wish to express their thanks to Med. Rath Dr. W. Hesse, for many valuable suggestions in connection with the studies herein reported.

REFERENCES.

(1) Fuller, Journal American Public Health Association, October '95, 381.

(2) Sedgwick & Prescott, Ibid., p. 450.

(3) Hesse & Nieder, Zeit. f. Hyg. u. Infec., '98, 29.

(4) Muller, Arch. f. Hyg., 38, 350.

IS THE COLON BACILLUS A NORMAL INHABITANT OF THE INTESTINES OF FISHES?

By JOHN A. AMYOT, M. B., Toronto, Ontario.

This work was prompted by the question,—Can fishes of themselves give the colon bacillus to a drinking water?

The intestinal contents of twenty-three fishes were examined. The twenty-three were divided amongst fourteen varieties, viz: nine "pickerel" (three forms, "blue," "yellow" and "sand"), (Stizostedium Canadensis); two "sheep head" (Aplodinotus Grunniens); two "black-bass" (Inicropterus dolomien); two "suckers" (Catostomus Teres); one "herring" (Coregonus Artedi); one "white-bass" (Roccus Chrysops); one "perch" (Perca Americana); one "broad-mullet" (Moxostoma Carpio); one "catfish" (Amiurus nebulosus); one "mullet" (Moxostoma Macrolepidotum); one "moon-eye" (Hyodon Tergisus), and one German carp.

These fishes were examined within an hour of coming out of the water from a trap-net at Port Stanley, Ontario, (Lake Erie), during the month of August, 1901. The intestinal contents were collected as follows: After opening the fish the intestine at a point some inches from the cloaca was seared and incised. A platinum loop was used to remove the contents to an agar-tube (+ 1.5), and at the same time to a gelatine medium containing .5 per cent. of carbolic acid. These were, after some days delay (they had to be taken to the laboratory in Toronto), incubated at 37° C. for forty-eight hours, then left in the cold until farther steps could be taken with them.

From both the agar (these all showed growth) and the gelatine-tubes (five were liquefied), sowings were made into "Smith-tubes" containing litmus-dextrose-broth, (2 per cent. dextrose) and left at 37° 38.5° for seven days.

Eight of the gelatine sowings in the litmus-dextrose-broth showed growth, (of these two were cocci, the rest bacilli). The remaining ones were sterile. None produced gas. All of the agar sowings in litmus-dextrose-broth showed growth. One produced gas, the corresponding gelatine sowing showed cocci in the litmus-dextrose-broth. Gas production only was used as the test for the colon bacillus.

These results would seem to indicate that the colon bacillus is not a normal inhabitant of the intestines of fishes.

A large percentage of the varieties of fishes examined are regular scavengers, the nets from which they were taken were situated not more than two miles from the harbor, into which a small river draining a thickly inhabited district flows. One would expect the colon bacillus to be present as they are in clams and other organisms in rivers, as has been pointed out by Hill with reference to the Charles River at Boston.

Colon bacilli grow easily on both the agar and the gelatine used. Only eight of the gelatine sowings into litmus-dextrose-broth grew. If colon be present in their intestines they have lost their property of resisting this percentage of carbolic acid. Perhaps the low temperature at which these fishes live has caused the bacilli to lose their gas-forming property. They might possibly be re-educated to the resistance to carbolic acid and to gas-formation by graded higher temperature treatment, and time will be required for this.

SOME COMMON BACTERIA IN AMERICAN STREAMS, INCLUDING SOME NEW SPECIES ISOLATED AT NEW ORLEANS, LOUISIANA.

By ROBERT SPURR WESTON and ARTHUR I. KENDALL,
New Orleans, La.

During the course of the Water Purification Investigation at New Orleans, it has been found necessary to compare the several new species of bacteria which have been isolated from the Mississippi River water, with the descriptions of bacteria which have been isolated by other investigators in other places.

This comparison has been attended with considerable difficulty because of the inaccessibility of the literature, the lack of uniformity in the methods of classification and differentiation, the incompleteness of specific tests, and the indefiniteness of the language used in descriptions. This paper, therefore, is an attempt to bring together scattered data, and to describe and tabulate into convenient form the more common bacteria of American streams.

A decade ago the subject of species differentiation was in a state of incertitude; each investigator worked independently, using his own methods.

It must not be thought, however, that this former tentative work was without value, as it furnished data—though perhaps negative data—which have been very useful in developing the greater scientific accuracy of the modern work.

SYSTEM OF GROUPING.

Many attempts have been made to classify bacteria according to some natural system. Many of these systems are extremely elaborate and are almost useless to the ordinary laboratory worker. Chester, (Report of the Delaware Agricultural College Experiment Station), has divided bacteria in twenty-five groups. This classification, however, while excellent and while carried out along rational lines, is perhaps too much amplified for present adoption, when the inaccuracies of bacterial methods are taken into consideration.

Up to the present time, the most useful system for ordinary laboratory workers which has appeared is that described in the paper of Fuller and Johnson, (Journal of Experimental Medicine, Volume IV., Nos. 5 and 6, 1899, also Journal of this Association, Volume XXV., page 580, et seq.) This paper is especially valuable because it recog-

nizes both the accuracy and inaccuracy of the present methods, and endeavors to eliminate those methods as bases of classification which do not give nearly constant results in the hands of ordinary observers. Fuller & Johnson especially take into account the following important points:

1. Vitality of the organism at the time of cultivation for the purpose of obtaining classification data.
2. Composition and proportion of culture media.
3. Temperature and period of cultivation of incubation.

As mentioned above, their work has also been of great service in helping to eliminate doubtful means of differentiation and in furnishing information regarding the percentage constancy of the conventional tests. The arrangement of species into groups according to their method depends upon:

a. Fluorescence and chromogenesis.
b. Liquefaction of gelatine.
c. Well marked characteristics of typical colonies on gelatine plates.
d. Fermentation of carbohydrate.

On the basis of these provisional tests, thirteen groupings were decided upon. The writers have changed their system of grouping in the following particulars:

Group I. includes all fluorescent forms, whether producing pigment or not.

Group V. includes the blue forms as well as the violet.

This makes the following groupings, which the writers have used throughout our work:

Group I. All fluorescent forms, whether producing pigment or not.

Group II. All red chromogenic forms.

Group III. All orange chromogenic forms.

Group IV. All yellow chromogenic forms.

Group V. All violet and blue chromogenic forms.

Group VI. All non-fluorescent, non-chromogenic, gelatine-liquefying bacteria, forming proteus-like colonies on gelatine.

Group VII. All non-fluorescent, non-chromogenic, gelatine-liquefying bacteria, forming subtilis-like colonies on gelatine.

Group VIII. All non-fluorescent, non-chromogenic, non-proteus and non-subtilis-like bacteria, which liquefy gelatine and ferment carbohydrate with the production of gas.

Group IX. All bacteria forming to the specified characteristics of Group VIII., except that fermentation of carbohydrate takes place without the formation of gas.

Group X. All bacteria conforming to the specified characteristics of Group VIII., except that no fermentation of carbohydrate occurs.

Group XI. All non-fluorescent, non-chromogenic, non-gelatine liquefying bacteria, which ferment carbohydrates with the production of gas.

Group XII. All bacteria conforming to the specified characteristics of Group XI., except that fermentation of carbohydrate takes place without the production of gas.

Group XIII. All bacteria conforming to the specified characteristics of Group XI., except that no fermentation of carbohydrate occurs.

The writers also believe that the following additional tests increase the value of the description; they give constant results in their hands.

1. The production of hydrogen sulphide in the alkaline broth under anærobic conditions. This test also definitely decides whether a form is a facultative anærobe or not.

2. In gelatine stab cultures the extent of growth at the surface of the gelatine, and along the line of inoculation; the form of the liquefied portion, whether cup shaped, funnel shaped or stratified.

3. In agar slant cultures, the presence or absence of a viscous growth; this is determined by the persistence with which a portion of the culture mass follows the needle when touched by and withdrawn from it.

4. Whether potato is discolored or not by the growth. This test is thought unimportant because the discoloration of potato by certain new forms which were isolated at New Orleans was marked and constant.

5. The gas formula $\frac{X}{CO_2}$ of the gases produced in the fermentation tube, as suggested by Russel.[1]

6. Growth in phenol-dextrose-broth, (100 grams dextrose, 50 grams peptone, 0.25 grams phenol, and 1000 grams water), as devised and used by Gage[2] at the Lawrence Experimental Station.

7. Whether or not nitrate is reduced to free ammonia.

8. Lactose-litmus-agar—the formation of red colonies which afterwards turn blue.

In one case, namely, that of Bacillus New Orleans No. 4, we have noticed that the cessation of motility in a broth culture was accompanied by a disappearance of the turbidity of the broth. This phenomenon illustrates the well known though perhaps not universal connection between the turbidity of the liquid media and the motility of the bacteria.

1 This Journal—Report of Minneapolis meeting—1899.

2 Journal Applied Microscopy, Vol. IV. No. 3.

In the descriptions of the new species, we have made use of forty-four tests in each case.

Fuller and Johnson increased the percentage constancy of the various differential tests by a system of preliminary cultivation as follows:

"After obtaining the bacterium in the pure culture, it was transplanted to nutrient broth; from the latter, after three days development at 20° C., to gelatine plates; thence, after the same period and temperature of cultivation, back to an agar tube; and, finally, after the agar tube culture had developed for three days, at 20° C., the conventional media were seeded."

The various reactions of the cultures which were isolated at New Orleans, were first determined after the cultures had undergone the above system of preliminary cultivation, but early in the work it was discovered that frequent transferences from broth cultures into fresh broth developed cultures which gave more constant and sharper reactions with the various media than did the method used by Fuller and Johnson.

The bacteria, when isolated for the first time, were inoculated into the various media, using the Fuller-Johnson method of preliminary cultivation. When these cultures were put through the second or confirmatory sets of tests, they were first transferred into successive nutrient broth cultures and were kept at a temperature of 20° C. for various periods. After the cultures were proved pure by plating, the bacteria were seeded into nutrient broth and agar slant tubes, from which the conventional media were seeded as in the Fuller-Johnson procedure.

The results of the second course tests confirmed the first, and indeed many of the tests were repeated a third or fourth time with the same results.

To make the descriptions more trustworthy, one of us—A. I. K., took the cultures to Lawrence, Massachusetts, and described the bacteria under entirely different climatic conditions, using new media after the same formula, but seeding the conventional media only after the following elaborate preliminary cultivation. The method used was as follows:

The purity of the cultures having been ascertained by the usual method, one colony from each of two duplicate plates was transferred into nutrient broth tubes.

(Both of these transferred species reacted alike with the various media).

The bacteria were then cultivated in the nutrient broth for three days at 20° C. and transferred thence successively into four more nutrient broth tubes with an incubation period of two days at 20° C.

intervening between each transference. It was found that the rapidity of the growth and therefore the virility of the culture was increased with each transference up to and including the fourth; beyond the fourth, the preliminary cultivation seemed to produce no further effect.

The conventional media were inoculated directly from the nutrient broth tubes.

With the above and the following exceptions, the writers used the methods adopted by the American Public Health Association:

a. The nutrient dextrose-broth had a neutral reaction instead of 1.5 per cent. acid.

b. Motility was determined by comparing two forty-eight-hour broth cultures, one of which had been killed with formaldehyde.

3. Broth, gelatine and agar of three reactions, namely, plus 1.5 per cent. neutral, and minus 1 per cent. were used.

d. Neutral milk was used.

Growth and results were recorded after a four, seven and ten days incubation period respectively. With the exception of one gelatine liquefaction which appeared on the ninth instead of on the fifteenth day of incubation, and one nitrite reduction which was positive instead of doubtful, the descriptions made at Lawrence agreed precisely with those made at New Orleans and speak for the accuracy of the work, the only difference indeed being due to the higher percentage constancy of the reaction, due to the improved preliminary cultivation. All of the new species were put through eleven series of tests and we feel that any careful bacteriologist giving the same attention to detail, would get results identical with ours for the species studied.

The following chart gives the results of the work in graphic form. The descriptions of the New Orleans species are tabulated alongside of the descriptions of other observers in other places, many of which latter descriptions have been confirmed at New Orleans. Among these descriptions is that of bacillus enteriditis sporogenes (Klein), which we worked out independently, using a culture which had been made from the Mississippi River water before Klein published a description of the same bacillus from European sources.

In general, we have recorded the results of the different tests by using the plus and minus signs, respectively. The absence of signs means that we are ignorant of any data in the specific connections. This method of recording results gives very little idea of the intensity or rapidity of growth in the various media. Fischer (Structure and Functions of Bacteria, Oxford, 1900), has suggested the use of the following characteristic signs.

SERIAL NUMBER	NAME	INVESTIGATOR	Morphology: Form	Motile	Spores	Group	Biology: Gelatine Colonies: Surface Growth: Nutrient Broth: Pellicle	Turbidity	H_2S Produced	Nutrient Agar Slant: Growth	Gelatine Stab: Surface Growth	Line of Growth	Gelatine Plate: Characteristic Colonies	Appearance	Liquefaction	Potato	Litmus Milk: Digested	Growth in Closed Arm	Remains of Curd	Facultative Anaerobe	Affected by Ranges of Temperature	Gas Production	Liquefaction: Coagulum	Clears	Blood Serum	Dextrose Broth: Gas Produced	Nitrate Reduced	Indol Produced	Milk Coagulates	Fecal Odor	Chromogenesis: Pigment	Nutrient Agar Slant: Color	REMARKS
1	B. Fluorescens Liquefaciens	Flügge	B			I																											New Orleans
2	non	Eisenberg	B			I																											B. Immobile Kreuse
3	Viridis	Lasage	B			I																											B. Lesagii Travaux
4	Fluorescens Oralis	Rullene	B			I																											
	Pyocyanea	Gessard	B			I																											
6	Fluorescens Incognitus	Wright	B			I																											
	Lactis Erythrogenes	Hueppe	B			I																											
8	Prodigiosus Fluorescens	Unger	B			I																											B. Uterus
9	N. O. No. 1	Weston & Kendall	B			I																											
10	N. O. No. 2	Weston & Kendall	B			I																											Turbidity disappears on 4th day. Nitrate reduced to NH_3
11	Prodigiosus	Eisenberg	B			II																											
12	Kiliensis	Eisenberg	B			II																											
13	Kiliensis	Griffin	B			II																											
14	N. O. No. 3	Weston & Kendall	B			II																											
15	Aquatilis Sulfureus	Flügge	B			III																											Forms sulfur granules
16	Viscosus	Russell	B			III																											
17	Limosus	Migula	B			III																											
18	Limosus	Zimmermann	B			III																											
19	Aquatilis	Eisenberg	B			III																											
20	Radiatus Aquatilis	Migula	B			III																											
21	Fluvialis	Migula	B			III																											Non-motile
22	Sporogenes Vesiculosus	Flügge	S			III																											
23	B. Nigrificans	Weston & Kendall	B			III																											Forms sulfur granules. NH_3
24	Cyaneofluorescens	Migula	B			IV																											
25	Cyaneus	Migula	B			IV																											
26	Fluorescens	Migula	B			IV																											
27	Subflavus	Lehmann & Neumann	B			IV																											
28	Subtilis Vulgaris	Migula & Hunter	S			IV																											
29	N. O. No. 4	Weston & Kendall	S			IV																											
30	Fluorescens Non-liquefaciens	Migula	P			IV																											
31	Fluorescens	Migula	P			IV																											
32	[illegible]	[illegible]	C			V																											Forms [illegible]
33	Mycoides	Flügge	B			V																											Forms [illegible]
34	[illegible]	[illegible]	C			VI																											
35	Ruminatus	Migula	D			VI																											
36	[illegible]	Migula	C			VII																											Non-motile
37	[illegible]	Migula	I			V																											
38	Filiformis	Migula	I			VIII																											
39	[illegible]	Eisenberg	B			VIII																											
40	[illegible]	[illegible]	I			VIII																											Forms [illegible]
41	[illegible]	[illegible]	B			VIII																											Forms [illegible]
42	[illegible]	Migula	B			IX																											Non-motile
43	Acetosus	Migula	B			IX																											
44	[illegible]	[illegible]	C			IX																											
45	N. O. No. 5	Weston & Kendall	I			X																											
46	[illegible]	[illegible]	C			X																											
47	[illegible]	Migula	C			X																											
48	Viscosus	Migula	D			X																											
49	Cyaneus	Migula	B			X																											
50	[illegible]	[illegible]	[illegible]			X																											
51	N. O. No. 6	[illegible] Kendall	I			X																											
52	[illegible]	[illegible]	[illegible]			XI																											Non-motile
53	Vesiculosus	[illegible]	B			XI																											
54	[illegible]	[illegible]	[illegible]			XII																											Forms [illegible]
55	[illegible]	[illegible]	B			XI																											
56	[illegible]	[illegible]	[illegible]			XI																											
57	Acetosus Subflavus	[illegible]	B			XI																											
58	[illegible]	[illegible]	[illegible]			XII																											
59	N. O. No. 7	[illegible] Kendall	B			XII																											
60	[illegible]	[illegible]	[illegible]			XII																											Forms [illegible]
61	Viscosus	[illegible]	B			XIII																											

+++ Very luxurient growth, (great turbidity or heavy surface pellicle).

++ Moderate growth, (distinct turbidity or delicate surface pellicle).

\+ Growth, (liquid opalescent surface pellicle, visible only upon shaking).

O No growth.

The writers have used these signs to describe five out of the nine new species isolated at New Orleans, but they have only a superfluous descriptive value and do not serve to differentiate the species as they are known at present.

It will be noted in the table that no attempt has been made to give names to the nine hitherto undescribed bacteria which have been isolated from the Mississippi River water and which the writers designate as "New Orleans, No. 1, No. 2, No. 3," etc.

Although many of the bacteria isolated at other places have also been isolated at New Orleans, yet the predominant forms here are what may be termed normal water forms, there being comparatively few of the forms which are usually associated with sewage pollution. For example: We were unable to find any evidences of the presence of bacillus coli communis in the water during a period of five months, although 300 c. c. were taken for the daily test. Liquefying forms were abundant, but the samples rarely contained gas-producing bacteria.

Well known bacteria, previously described, which have been isolated from the Mississippi River water at New Orleans, are designated by the words "New Orleans" in the "Remarks" column.

This table and this paper is an attempt to describe the species of bacteria isolated at New Orleans, and the species isolated at other places by other observers, in the same terms, not that these descriptions may be considered complete, but with the hope that some contribution may be made toward the knowledge of the subject; that existing descriptions may be made convenient for reference, and that the data here presented may prove useful in furthering the ultimate uniform classification of water bacteria along rational lines.

Laboratory of the Sewerage and Water Board of New Orleans, September 11, 1901.

ABSTRACT OF "REMARKS REGARDING THE INVESTIGATION OF BACILLUS COLI IN WATER."

By GONZÁLES FABELA,

Prepared in the Laboratory of Bacteriology, Board of Health, City of Mexico.

The author first discusses the value of the detection of bacillus coli in potable waters. A discussion of the relative merits of the "extra organic" and intra organic methods of the determination of the presence of this organism.

As an example of the former he takes the methods used at the Lawrence Experiment Station (1), and of the latter the method of Poujet and Bonjean in Paris (2). He summarizes them and relates his experience with both as follows:

The various times of the processes of Paris may be detailed in the following manner:

FIRST DAY.

Cultivation of water in fenicated solution.

THIRD DAY.

Recultivation in peptoned solution.

ELEVENTH DAY.

Investigation of indol and intraperitoneal injection of a guinea pig.

TWELFTH TO THIRTEENTH DAY.

If the guinea pig dies microscopical perparations and cultivation of the pathological products in lactose litmus gelatine, glycerine agar, potatoes, milk, solution of pepton and gelatine Elsner.

THIRTEENTH TO FOURTEENTH DAY.

Observation of the lactose litmus gelatine, of the glycerine agar, of the potato and of milk.

FIFTEENTH TO SIXTEENTH DAY.

Investigation of indol.

TWENTIETH TO TWENTY-FIRST DAY.

Observation of the gelatine Elsner.

Recultivation in Elsner's gelatine.

ELEVENTH DAY.

If there are colonies similar to those of the coli, recultivation in solution of pepton.

NINETEENTH DAY.

Investigation of indol and recultivation in lactose litmus gelatine, glycerine agar, in potato, milk and gelatine of Elsner.

TWENTIETH DAY.

Observation of the lactose litmus gelatine, of the gelatine agar, of the potato and of the milk.

TWENTY-SECOND DAY.

Investigation of indol.

TWENTY-EIGHTH DAY.

Observation of the gelatine Elsner.

"In regard to the American process, will only mention that the means of cultivation are prepared with substances of simpler composition that have chemical reaction of a determined degree and that supply all its indications on the tenth day."

"Among the analyses of waters practiced in the Bacteriological Laboratory of the Board of Health of Mexico, I had to make that of the water of the drains after it left the Valley of Mexico by the canal and tunnel, which constitute the drainage works, constructed in 1896."

"The water for the analysis was taken at a short distance from the mouth of the tunnel, which is 57,600 meters from the city. I took two samples from different places three kilometers apart without there being between them any cause of contamination of the waters, and I made the analysis with the same samples and simultaneously by both processes; the results were as follows:"

"First sample taken immediately before the bridge, presence of the bacillus coli by the American process and doubtful results by that of Poujet and Bonjean."

"Second sample taken about three kilometers distant, from the river, presence of bacillus coli by both processes. Besides, I obtained by the American process colonies of proteus vulgaris."

"This practical fact, if it were the only one, would be eloquent enough: the becillus coli whose presence could be assumed a priori, by the origin of the water, appears with its characteristic reactions in both samples examined by the process followed in Boston; the other process indicates doubtfully the existence of the coli in the first sample, while it shows it with all clearness in the second, which could not contain any species not present in the first. Similar results I have obtained subsequently with other waters."

The author criticises the second method on the theoretical grounds that animals vary in susceptibility, that the colon bacillus of the intestine invades the tissues after death, that the potato of Elsner's medium is a very uncertain quantity.

He says of the American process:

"It needs only that the microbe be alive, either virulent or not, to demonstrate clearly its presence. It is only necessary to undertake the

principal reactions for the recognition of species. Its means of cultivation are of a simple composition and the substances employed are less exposed to variations in composition. The exactness of the duration of the periods of the process, the growth under uniform temperatures, and the use of the means of cultivation having the same chemical reactions make its result acceptable almost as confidently as definite chemical reactions.

THE SIGNIFICANCE OF THE PRESENCE AND AMOUNT OF CARBON DI-OXIDE IN POTABLE WATERS.

By ELLEN H. RICHARDS, Boston, Mass.

Within a few years discussion has arisen as to the significance of the presence of much or little carbon di-oxide in potable water, the argument being that, like ammonia, it was a product of the decay of organic matter which, as a rule, contains fifty per cent. of carbon and therefore that the presence of much CO_2 might show the recent decay of such organic substances.

Nature does her work by very complex processes and it is rarely the case that the full story can be picked up as easily as a telegraph cable at the bottom of the Atlantic.

Suppose a dead cat or a head of cabbage to be buried under six feet of compact loam. The carbon di-oxide formed would dissolve in the down trickling water and might be carried with this water, becoming colder, long distances in the gravels or through rock crevices until the water was drawn to the surface by a pump or escaped as a spring. If one finds twenty parts in a million of CO_2 in such a water, how is one to know if it came from a cat or a cabbage and if one does not know *that* what is the use of knowing the amount?

The assumption seems to have been made that contaminated surface waters also gave the highest CO_2 and the tests reported herewith were made with that in view.

At first it seemed as if pools full of tadpoles and drains from the roadside did show increased amounts but further study of uncontaminated woodland regions revealed still higher amounts, showing that vegetable decay is the chief source, and leaving the question to be one of the *significance* of this decay.

The results on pools and lakes good enough for water supplies and those in the same region not fit to be so used, failed to reveal a decided difference; not nearly so large variations were found as in the water of different parts of the same lake under varying conditions of vegetation. Obeying the law of solubility as governed by the law of partial pressure of gases, it appears that the tendency of CO_2 is to diffuse into the air above and so to keep an equilibrium in all surface water.

Certain bodies of water are infested with a floating, unattached vegetation, when this consists of blue-green algae in considerable amount the dissolved CO_2 furnishes the carbon in readiest form for their growth and it soon becomes exhausted, the water remaining

alkaline so long as that growth is vigorous and showing an increased amount on the decay of the algae. So far, this effect has been observed only in connection with blue-green algae, not with diatoms or other algae.

More data must be accumulated before an opinion can be ventured as to the value of the determination of CO_2 in ground waters. Taken by itself it is not convicting but considered with the presence of nitrates it *may* give information valuable enough to warrant adding it to the list.

In view of the lack of exactness in the meaning of the results when obtained, it is hardly necessary to go to great refinement of method and for the present the Seyler method would seem to be satisfactory.

SURFACE WATERS—PARTS PER MILLION FREE CARBON DI-OXIDE.

1901.

0.5 Part or Less.

April 4—Jamaica Pond.
May 20—Boston Tap.
May 26—Stream, Sharon, Mass.
May 30—Brook, Newburyport, Mass.
June 17—Lakes Paugus, Winnesquam and Winnepesaukee, N. H.
June 25—Lake Placid, Mirror Lake, Heart Lake, Adirondacks.
July 2—Cascade Lake and Cascade Fall, Adirondacks.
July 12—Boston Tap.
July 17—Buckmaster Pond, Norwood, Mass.
August 17—Crystal Lake, Gardner, Mass.

0.6 to 0.8 Part.

April 4—Boston Tap.
April 29—Boston Tap, Chebacco Lake, Gloucester, Mass.
May 30—Merrimac River, at Newburyport, Mass., and five streams in Newbury.
July 4—Large stream in the heart of the Adirondack woods.
July 9—Jamaica Pond, Ward's Pond, Jamaica Plain, Mass.
July 20—Neponset River, Quincy Tap, Hingham Tap.
August 30—Boston Tap.

1.0 to 1.5 Parts.

April 30—Merrimac River, at Lawrence.
May 26—Lake Mollywallopog, Sharon, Mass.
May 30—Merrimac River, dirty dock, Newburyport.

1.5 to 2.0 Parts.

May 26—Large brook, Sharon woods.
May 30—Roadside pool, Newburyport, frequented by cattle.
June 26—Clear brown brook from the Adirondack woods.
July 9—Muddy lily pond, Arnold Arboretum.

2.0 to 3.0 Parts.

May 30—Pollywog pool, Newburyport, Mass.

3.0 to 4.0 Parts.

May 26—Shallow pool, with bottom of dead leaves, Sharon, Mass.

4.0 to 5.0 Parts.

5.0 to 6.0 Parts.

July 7—Clear water from Adirondack forest.

6.0 to 7.0 Parts.

July 7—Dark brown water from Adirondack forest; roadside pool in the forest where rainwater had collected.

ALKALINE.

Jamaica pond, whenever the oscillaria grew vigorously.
Pond, Boston Public Garden, in August (the frog pond=0.6 part acid).
Duck pond, Franklin Park.
Pond in Leverett Park.
Fresh pond, Cambridge, July and August.
Mirror Lake, Adirondacks, nearly alkaline when the spherozyga appeared.

GROUND WATERS—PARTS PER MILLION, FREE CARBON DIOXIDE.

June	17—Spring from mountain side, near Lake Winnepesaukee	0.9	part
July	20—Well, Pleasant street, Hingham	1.8	"
May	26—"Artesian" well, 150 feet deep, Mattapoisett, Mass	2.0	"
May	26—Well, Dalton	2.5	"
July	1—Brookwood spring, Adirondacks	3.0	"
March	18—Well, Newburyport, Mass	3.0	"
March	18—Well, Cambridge, Mass	3.0	"
March	20—Two wells, Hardwick, Mass	3.0	"
March	18—Nobscot spring, Framingham, Mass	4.4	"
March	18—Everett crystal spring, Everett, Mass	5.0	"
March	20—Well at Hardwick, Mass	5.0	"
March	20—Ground water pumped from tunnel building for sewer at Jamaica Plain	5.0	"
August	17—Well on Templeton Common, Mass	6.0	"
March	20—Well at Hardwick, Mass	7.0	"
July	4—Well at Adirondack Lodge, N. Y	9.0	"
March	20—Well at Hardwick, Mass	10.0	"
July	12—Spring in Franklin Park, Boston	11.5	"
March	20—Well at Hardwick	12.0	"
June	25—Well at John Brown's grave, Adirondacks	14.0	"
August	17—Well by Templeton Inn	14.0	"

The last four are polluted waters.

REFINED AND IMPROVED ANTITOXIN PREPARATIONS.

By JOSEPH McFARLAND, M. D.,

Professor of Pathology in the Medico-Chirurgical College of Philadelphia.

During the decade that has passed since Behring and his co-workers made their preliminary announcements concerning the antitoxic power of immune serums, an immense amount of experimental and clinical work has resulted in the manufacture and employment of these serums in nearly all parts of the world.

In spite of all the investigations conducted in the laboratories of Europe and this country, where the best available talent has been secured, our methods of preparing and dispensing the serums are essentially identical with those of the pioneers.

It is less surprising that the method of manufacture has not changed, than that the form in which the serum is employed has not changed. The former, depending as it does upon the production of an artificial immunity, secured by the progressive administration of cultures or toxins is necessarily surrounded by limitations that permit of modification in minor details only. The latter, on the contrary, is subject to chemical manipulations of various kinds by which its virtue can be extracted, its quality improved, its power increased and its physical condition entirely changed. It is, therefore, with surprise that we find the profession still demanding the unmodified serum for therapeutic use, and continuing for ten years to inject their patients with *"horses' serum" instead of antitoxin.*

The object of this paper is to call your attention to certain manipulations by which the serums can be improved. The two most important being *concentration* and *precipitation.*

I. *Concentration* by the extraction of its watery constituent is a treatment which greatly improves the serums by securing the antitoxic principle in a greatly reduced volume.

This is a great gain as it enables the physician to administer with a hypodermic syringe a dose of serum that must otherwise be given in a large antitoxin syringe, and also lessens the tumefaction resulting from the injection and causes much less pain. A further consideration is the fact that by judicious concentration stronger serums can be prepared than have yet been marketed, and serums of the usual strength made much more economically than at present—a very important consideration where municipalities purchase for gratuitious

distribution, or where serum is for use among the poor. An enthusiastic reception should be tendered a carefully made "concentrated antitoxin."

Every advantage is unfortunately accompanied by disadvantages and to these attention must be directed in order that a fair judgment regarding the preparation can be made.

First. When 33 per cent. of water is removed from the serum its viscosity is increased so that it may impede its progress through a hypodermic needle. Every concentrated serum will be of greater density than normal.

Second. With the removal of the water *the relative portion of fluid and solids is altered* so that the serum contains an increase of albumin, globulins, salts, etc.—all of which (except the antitoxin globulin) may not only be undesirable, but even injurious.

The degree of concentration can be determined by estimating the solids in a given bulk of any serum. More than 10 per cent. of solids should be viewed with suspicion in serums not supposed to be concentrated.

Third. The increased percentage of solids brings with it an *increase in some of the irritative elements in the serum*, so that a concentrated serum may, in proportion to its bulk, produce greater local disturbance than a normal one, though not in proportion to the quantity injected. That is 5 c. c. of an unconcentrated serum, but not as much disturbance as 10 c. c. of a normal serum. Thus in concentration there is a decided advantage.

Dry powder can be prepared by evaporating the serum to dryness in vacuo. The powder thus secured is very convenient for transportation, remains for a long time undiminished in strength, and needs no antiseptic to preserve it. It is thus superior to the original serum. It, however, lacks solubility and when placed in water forms a gummy mass which dissolves very slowly. This lack of solubility is an objection that entirely outweighs its value so that it can not be recommended for use.

II. *Precipitation.* Many chemical investigations and attempts to isolate the antitoxic principle from the serum have been made. Chief among these are the experiments of Brieger and Boer, who found it possible to precipitate the antitoxin with salts of the heavy metals, but not to separate the antitoxin from the combination. Park and Atkinson found the antitoxic principle almost exclusively in the globulins, with which it is precipitated. My own experiments show this to be correct, and by the precipitation of the globulins nearly all of the antitoxin is removed from the serum.

The globulins can be precipitated with ammonium sulphate, the salts removed by dialysis, and the secured globulin evaporated to dryness. There then is secured a whitish powder which is light in specific gravity and readily soluble in physiological salt solution. The salt used for precipitating the globulin and the duration of dialysis contribute towards the subsequent solubility of the precipitate.

The globulin precipitate therefore contains the antitoxic principle separated from the useless substances contained in the serum, convenient for shipment, readily soluble, and active for therapeusis.

It has been shown by Park, that the irritating properties of the serum are chiefly the globulins, but fortunately it does not seem true, that the dissolved globulin precipitate is more irritating in equal strength and diminished quantity. It is simply a means of utilizing, as nearly as may be, the antitoxic globulins apart from the serum albumins, salts, etc., and free from antiseptics and other substances added in the laboratory for purposes of preservation. To my mind it would be much better to employ the pure globulin without any antiseptic, than to employ the best serum with an added antiseptic. This is, however, a matter of opinion. It is also a matter of opinion whether it is safe to use the serum without any added preservative.

The globulin precipitates when dissolved are subject to bacterial infection and decomposition, so that it is important to make the solution fresh before using, to make no more of the solution than is necessary for use and throw away any excess.

ANTITOXINS AND AGGLUTININS.

By THORVALD MADSEN, Kopenhagen.

SOME ANALOGOUS PHENOMENA OF THE VARIATION OF PRODUCTION ARISING DURING ACTIVE AND PASSIVE IMMUNIZATION.

It was in 1893 that Ehrlich and Brieger found that by administering single injections of tetanus toxin to a goat, already immunized against tetanus, a change in the antitoxic value of the serum was obtained.

This change consisted at first in a fall, followed by a considerable rise, then by a second fall which continued until a degree of relative equilibrium was reached.

These experiments being discontinued, the subject was practically abandoned by those observers, and it was in the endeavor to obtain further information that somewhat similar experiments were undertaken by Professor Salomonsen and myself in 1896. In the investigations which were made with diphtheria toxin, horses were used for experimentation, and in a large number of cases we were able to show that similar conditions were brought about, as was stated by Ehrlich and Brieger in their work on tetanus toxin upon the goat.

Since then, work has been carried out at different periods in the laboratory of the University of Kopenhagen, covering more extensive and varied fields of investigation along similar lines, and research is still going on and will likely occupy years yet, before it can be said that an end has been reached. In consequence, we are not yet in possession of final results, but we have obtained some facts of a gratifying nature, some of which, I think, are worthy of being brought to the attention of workers in this department of science, so that fresh impulse might thereby be given towards a clearing up of the many obscurities which at present block satisfactory progress. It will be, therefore, only a small portion of the results of these experiments, performed by Dr. Jörgensen and myself, that I will endeavor to present to you in the limited time at my command. These comprise a partial study of the relationship of the phenomena met with in the production of the agglutinins of Bac. typhosus and Sp. choleræ asiaticæ, and of the antitoxins of B. diphtheria and B. tetani. And it was to enlarge the scope of enquiry, by adding to the variety of anti-bodies examined (the agglutinins being so different from the antitoxins), that we made use of these cultures.

I will not here enter into the details of investigation, further than to say, that different animals such as the rabbit, cat and goat were used

in the experiments and were inoculated at definite periods with varying doses of twenty-four hours old bouillion cultures of B. typhosus and Sp. choleræ asiaticæ, respectively, and it mattered not whether living or dead cultures were employed. The testing of the agglutinating power of the serum was performed by the usual method of precipitation in test tubes. The sum total of the results of our several experiments was plotted out on paper, taking the form of a curve which rose from a base-line representing the days upon which the tests were made, whilst the degrees of measurement were marked off on a vertical line at the left hand side and simply expressed the relative degrees of power of agglutination, being quite arbitrary in nature.

Our experiments were divided into two classes:

First. That of active immunization.

Second. That of passive immunization.

In respect to active immunity, we used rabbits and goats which had at a previous date been immunized with living cultures in small and increasing doses, the former animals being inoculated intraperitoneally, whilst the latter were treated subcutaneously. Now, when the animals received one single large dose (e. g., 5 c. c. for rabbits and 100 c. c. for goats), of the particular culture, it was found from the many experiments performed that the lines of agglutinic power, when plotted out, showed at first a slight fall in value, succeeded by a sudden rise whose maximum occurred with regularity between the eighth to the twelfth day, and then fell off either slowly or suddenly. Especially, in the case of rabbits, marked differences in the acme of the curves were to be seen, which, I think, are of sufficient importance to warrant relating in detail. Briefly, three rabbits, which at a previous date had been immunized in exactly the same manner, showed upon a certain day the following degrees of agglutinating power:

No. 1.....30°
No. 2.....40°
No. 3.....50°

Thereupon, each received 5 c. c. of the same bouillon culture of B. typhosus, and, when examined later on, the agglutinin values showed great variation; that of

No. 1 reaching..... 300°
No. 2 reaching.....1850°
No. 3 reaching..... 80°

But what was equally remarkable, was the fact that the acme of the curve of each was reached upon the 9-10 day.

Here, we have a most remarkable analogy between these agglutinins and the antitoxins of B. diphtheriæ and B. tetani, where, in the latter cases, the rise of the antitoxic curve is quite similar, and the acmes of both likewise occur on the same days.

Now, with this phenomenon before us, which is seen to be common to four such different bodies, as these agglutinins on the one hand, and the antitoxins on the other, might it not be worth our while to attack the problems involved in the production of immunity, not alone in regard to these anti-bodies, but in regard to other anti-bodies as well, by a complete study of the agglutinins first, and then begin the study of the antitoxins from facts derived from such sources? Likewise, by this method of investigation we avoid the very tedious technique involved in working upon animals in the determination of antitoxin, as the agglutination technique can be performed so readily and accurately in test-tubes alone.

Again, instead of administering one large dose of culture, an endeavor was made to imitate the possible conditions occurring in a case of typhoid infection in the human body, so animals were therefore given small daily injections of equal dose for a period of several weeks. Upon testing, we found that in the first five or six days there occurred an almost imperceptible fall in the agglutinating power, followed by a gradual rise, which attained its maximum about the twelfth day after the last injection, and then slowly fell, and this in spite of repeated injections, as if the production-capacity of the tissues of the animals was becoming tired out. This same phenomenon of apparent tissue-weariness occurred also in former experiments of Professor Salomonsen and myself, when working upon the immunization of horses with the toxins of B. diphtheriæ.

From amongst the many points of practical importance to be deduced from these experiments, I would like to emphasize two only:

First. The undoubted fact of the occurrence of maximum antitoxin (or anti-body) production upon the eighth and twelfth day after the last single injection of toxin, whereby the knowledge of this fact would lead to the prevention of loss of antitoxin in the bleeding of an animal at a period in advance of, or behind the acme.

Second. By the plotting of the curves of the anti-bodies, in experimentation upon the immunizing power of different races of microbes of the same species, we have the only sure means of estimating that power when present. And we also better avoid the error of overlooking the fact of the different individuality of tissue resistance amongst the animals themselves.

PASSIVE IMMUNIZATION.

In the production of passive immunization by the introduction of anti-bodies from a previously actively immunized animal into the blood of an animal, which has not been the subject of former experimentation, we have here to consider a matter of the utmost im-

portance, namely, are the antitoxin bodies produced in an animal of one species, by the use of the same culture or toxin, identical to those produced in the body of another animal of a different species? To determine this, a great number of experiments were undertaken by which passive immunization was produced in certain animals by using the sera of other animals actively immunized against typhoid or cholera organisms. It was found that the results obtained from their employment were quite identical.

Our observations were as follows:

First. When rabbits were injected with the agglutinin-holding serum of a goat, it was found that upon testing every day the agglutinic power of the rabbit's blood, its reaction became entirely negative in a few days (two-four as the case might be).

Second. When rabbits were injected with rabbit's serum, the agglutinic power was retained for weeks.

Third. With cats, a few experiments were made with goat's serum only; and it was noted, that, as in the case of the goat's serum upon the rabbit, agglutinic power was lost in a few days.

From these experiments then, it was proved that these anti-bodies were different, and it seemed at first justifiable to conclude that we had to deal with a law, by which it appeared that the anti-bodies of animals of one species always acted as foreign matter when introduced into the fluids of animals of another species, and as such, were at once rapidly excreted, whereas the anti-bodies from an animal of the same species were retained for a comparatively long time. This view was also put forward by Behring some years ago.

But this supposition we had to abandon in the light of further experiments, whereby we found that goats injected with rabbit's agglutinin-holding serum, and goats injected with goat's serum, both retained the agglutinins for a period of several weeks. These bewildering results leave us at present without a clue to the real state of affairs going on within the animal body during the processes of passive immunization, and thus lacking any specific law, it seems necessary that a great deal of experimentation is yet required to bring to light the fate of the anti-bodies of one animal within the body tissues and fluids of another. Especially interesting would it be to know how the human body would react to those various anti-bodies derived from different animals, for, by the acquirement of such knowledge, we might have at our command better means for curing, and especially for immunizing against disease. Finally, a series of experiments were undertaken to decide a question which was met with in active immunization, namely, what was the cause of the sudden fall of antitoxic power in a previously immunized animal, upon giving a fresh injection of

toxin of the specific organism? Brieger and Ehrlich have explained this phenomenon upon the grounds of chemical neutralization alone. Later, it was shown by the experiments of Salomonsen and Madsen, that such could not be the case.

For example, they had a horse whose serum contained 100 antitoxin units per c. c., or 5,000,000 units *in toto*. A quantity of toxin, similar in amount to that injected later into the horse, was *in vitro* neutralized by 50 antitoxic units, being the amount contained in ½ c. c. of the horse's serum. As a result of this, it was expected that when the horse received an equal quantity of toxin, little or no influence upon the antitoxic power of its serum would be observed. On the contrary, it was found that the antitoxic power fell off about 40 per cent. Thus we see, that we have a marked difference between the effects of toxins and antitoxins, *in vitro*, and in the tissues and fluids of an actively immunized animal.

In the hope of clearing this matter up, Jörgensen and myself undertook a series of experiments with the agglutinins of B. typhosus and Sp. choleræ asiaticæ upon various animals in the state of both active and passive immunization, and the results obtained were in all cases quite analogous, and can be best illustrated by a simple example.

A goat, never before the object of an experiment, was injected intravenously with typhoid goat-serum agglutinin, so that the serum when afterward tested showed an amount arbitrarily expressed as 50° in agglutinic power. Then, as is always the case following upon an injection, the agglutinic power rapidly fell during the first few days, and later on more gradually. When the serum had reached 30°, the animal was injected subcutaneously with 70 c. c. of a twenty-four hour old bouillon culture of B. typhosus; this produced no effect at all upon the degree of agglutinic power, and in the following days the amount kept on falling slowly and uninterruptedly as before the injection. Three weeks were allowed to pass until the goat's serum showed no agglutinic power on being tested, then it was injected subcutaneously with the same dose of culture as before. Now occurred a great rise in the power of the serum, which upon the ninth day reached its acme, about 200°, followed by a sudden fall, thus giving the typical curve seen in the active immunization, as indeed, such was the case. When the value of the serum had fallen to 50°, a further and similar injection of culture was made; and again upon the ninth day after, we found that the value of the serum had risen to about 10,000.

We see therefore from these facts, that an animal, when it receives into its body the preformed anti-bodies of another, fails to give any evidence of anti-toxin reaction when injected with culture, but, when this same animal is later on actively immunized, producing himself the

agglutinin, and again injected with culture, reaction in very great degree sets in. From this it seems, that the reaction observed in the passively immunized animals is, in a certain degree, analogous to that obtained in a simple test-tube experiment.

Such results are at present difficult of interpretation, and it may be possible, that the results obtained in the passively immunized animals are due to some subtle change occurring in the agglutinin during the act of removal from the body of the actively immunized animal, or mayhap, it is altered within the body of the second animal soon after being received.

Another consideration of importance brought out in the experiments, is the choice of method of injection. For example, in one case amongst several which came under observation during active immunization against diphtheria toxin, it was found that when an intravenous injection of toxin was made at a period when antitoxin followed, but on the contrary kept on falling. Yet, when a subcutaneous injection of the same amount of toxin was given at this period, there followed a slight fall in antitoxin, then a sudden, sharp rise, and again followed the usual gradual fall, as is seen in all cases of typical active immunization. It therefore seems to show that toxin is at once neutralized, when introduced into the circulating stream of antitoxin, but when injected subcutaneously, quite a specific interaction of a positive character results.

These facts, I think, should stimulate to further study of the reaction of toxins upon the subcutaneous tissues, or of the subcutaneous tissues upon the toxins, as the case may be.

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SOME WORK ON A CURATIVE SERUM FOR TYPHOID FEVER.

By WM. ROYAL STOKES, M. D., and JOHN S. FULTON, M. D.,
Baltimore.

Although the production of an antitoxin for diphtheria has resulted in a satisfactory clinical remedy for counteracting a disease mainly due to the absorption of a toxin, yet little if any progress has been made towards a remedy which will act favorably in diseases caused by the presence of bacteria themselves in the tissues or circulating blood.

The classical work of Pfeiffer and others has demonstrated that healthy animals can be rendered immune towards such bacteria as the spirillum of Asiatic cholera, and the typhoid bacillus. A single portion of the blood serum of immunized animals, added to 100 parts of a fluid culture, injected into the peritoneal cavity of a normal guinea pig produces a characteristic reaction. The bacilli clump and gradually become digested and destroyed. This is a specific reaction, and only occurs towards the organism against which the original animal was immunized.

Although these experiments have been carried on with animals, but little work has been done towards producing serums which will help to destroy the bacteria in human beings who already show signs of infection.

In order to test the effect of a serum of high immunizing power on cases of typhoid fever we have performed a series of experiments. Before describing these we shall briefly mention the work of Abell and Loeffler, (1) who produced a serum which protected animals against the typhoid bacillus in amounts much larger than the usual fatal dose, and even seemed to cure guinea pigs after they were artificially infected.

They injected subcutaneously fresh fluid cultures of the typhoid bacillus into dogs, using gradually increasing doses. They used a typhoid culture which killed 300 gram guinea pigs in doses of 1/50 of a loopful of agar culture, and then found that 0.001 of a cubic centimeter of this serum would protect guinea pigs against 100 times the minimum fatal dose in non-protected control animals. They also proved that 0.5 c. c. of their serum, injected intraperitoneally, would also cause animals to recover, even after they were sick from artificial typhoid infection. Animals inoculated with double the fatal dose who had been sick for eight hours were thus cured, while control animals died. They also showed that the serum of dogs immunized with one variety of the

typhoid bacillus will protect animals who have been inoculated with another variety. This would seem to show that this protective influence will extend to the entire species of frank typhoid bacilli.

In order to obtain a serum of the highest immunizing power it was decided to use pure virulent cultures of the typhoid bacillus for the purpose of injecting animals. The experience of others had already shown that such cultures can not be used for subcutaneous injection into horses, since large sloughs often form from their use. It was found, however, that hogs will stand the injection of pure untreated cultures of the typhoid bacillus without any discomfort.

An organism was obtained from the Johns Hopkins Pathological Laboratory called Bacillus No. 16, which was found to be virulent for guinea pigs in doses of one cubic centimeter when introduced into the peritoneal cavity. Forty-eight hour old cultures were used for injection, and on July 24 a dose of ten cubic centimeters was injected into the tissues of the abdomen of hog No. 1. These injections were continued in increasing doses at intervals of about ten days until December 31, 1900, when the dose had reached 1130 cubic centimeters of a pure bouillon culture of the typhoid bacillus. The temperature during all this time was never lower than 39.5° C., and never reached over 41° C. As the larger injections were given, the animal would sometimes remain quiet for a day, and lose its appetite. No sloughs occurred, and the health of the animal remained practically normal.

It is a difficult matter to inject such quantities as a liter of bouillon into the subcutaneous tissues of the abdomen of a hog, but we succeeded well, using the glass vessel intended for injecting salt solution. The fluid is best forced into the tissues by attaching the foot bellows of a blast flame by means of rubber tubing to the glass tube entering the top of the salt solution apparatus. The needle for injecting should be very stout, with a large lumen, and the one which we used had a lumen of one millimeter in diameter. By this means a liter can be injected through two punctures of the skin, one half a liter being forced into the loose tissue on each side of the groin. The skin should be washed and disinfected with five per cent. carbolic acid before each injection. Table No. 1 will show the date of each injection, the amount used, and the temperature twenty-four hours after.

As will be seem from table No. 1, the animal was bled three times, one liter of blood being drawn each time, which yielded about 200 c. c. of serum. After the first bleeding a month elapsed when 500 cubic centimeters were again injected, and in two weeks the animal was again bled. This was again repeated, and serums No. 1, No. 2 and No. 3 were thus produced. This serum was kindly drawn and trikresolized

by Dr. Lincoln of Mulford's laboratory, and we desire to thank him for his kindness.

THE AGGLUTINATIVE PROPERTIES.

A series of experiments had been carried on with this same hog, in which a liter of a pure bouillon typhoid culture was given to the animal as food every day for one month. This did not cause a distinct agglutinative reaction even at a dilution of 1 to 10. When the subcutaneous injections were begun, however, the agglutinative reaction began to rise, and on March 1 the hog's serum gave a distinct agglutinative reaction at a dilution of 1 to 45,000. This was called serum No. 1. On April 12, after the second bleeding, the agglutinative reaction fell to 1 to 30,000, and on May 15, after the third bleeding, the serum only gave a reaction at 1 to 15,000. Only complete reactions after two hours were counted, and all of these showed complete agglutination and cessation of motility even after twenty-four hours. Table No. 2 will show the gradual increase in the power of the agglutinative reaction.

EXPERIMENTS UPON ANIMALS TO TEST THE IMMUNIZING POWER OF THE SERUM.

The virulence of the typhoid bacillus in guinea pigs is very variable, and there are many typhoid bacilli which are only fatal to animals in large doses. Before beginning any experiments of a comparative nature between animals protected by the serum and unprotected animals, it was necessary to find a virulent typhoid bacillus.

A typhoid bacillus was first used which had been obtained from the autopsy on a fatal case of typhoid fever at the University Hospital. Seven guinea pigs were inoculated in the peritoneal cavity with one cubic centimeter of a twenty-four hour bouillon culture of this bacillus, but they remained well at the end of two weeks. All of the guinea pigs used in these experiments weighed between 300 and 400 grammes.

It was found unprofitable to use bouillon cultures of the typhoid bacillus for injection into animals, because large doses were needed to produce fatal results. It was found more convenient to use a growth on Loeffler's blood serum, and the following uniform method was pursued.

The blood serum slanted in a small tube measuring 1.5 cm. by 8 cm. will usually grow about four loopfuls of typhoid bacilli, the circumference of the loop measuring three millimeters. Four cubic centimeters of sterile Dunham's solution were added to each blood serum tube after the typhoid bacillus had been allowed to develop for twenty-four hours. The growth from the surface was thoroughly mixed with

the sterile Dunham's solution, and each cubic centimeter of this suspension therefore equalled one loopful of a twenty-four hour slanted blood-serum culture of the typhoid bacillus.

Through the kindness of Dr. Cole of Johns Hopkins Hospital, we obtained five different specimens of the typhoid bacillus, which he had isolated from the blood of patients during life. Each of these five specimens were inoculated in doses of two cubic centimeters into the abdominal cavity of two guinea pigs, but bacillus No. 1 and bacillus No. 4 were the only organisms that proved virulent. These organisms killed the animals in twenty-four hours, with purulent peritonitis and general septicemia. The animals inoculated with the other organisms all remained well for two weeks, and were then released.

The next series of experiments consisted in a comparative series of tests between animals inoculated with the typhoid bacillus alone, and those which had been protected by the serum before inoculation with the typhoid bacillus. Bacillus No. 1 and bacillus No. 4 were used for this purpose.

Two guinea pigs were inoculated intraperitoneally with two cubic centimeters of bacillus No. 1, and two other animals were inoculated with two cubic centimeters of bacillus No. 4. All of these animals died in twenty-four hours of purulent peritonitis and general septicemia, the typhoid bacillus being recovered in pure culture from the abdominal cavity, the blood of the heart, and the various viscera.

Three guinea pigs were given subcutaneous injections, each animal receiving one cubic centimeter of the protective serum, and three others were given 0.5 c. c. of serum. Two days later three of these same animals were given two cubic centimeters each of bacillus No. 1 by peritoneal injection, and three others were similarily inoculated with bacillus No. 4. All of these animals remained well for two weeks and were then released.

It is seen from this that 0.5 c. c. of this serum, injected subcutaneously, protected these animals against doses that would otherwise have been fatal.

In order to determine whether the bacilli Nos. 1 and 4 were virulent and fatal for guinea pigs in smaller doses than two cubic centimeters, two animals were inoculated with one cubic centimeter of bacillus No. 1, and three animals were inoculated in the abdominal cavity with 0.5 of a cubic centimeter of this bacillus. Similar inoculations were also made with bacillus No. 4. All of these animals, except two, died in from twenty-four to forty-eight hours of typical experimental typhoid infection. One of the surviving guinea pigs had received 0.5 c. c. of bacillus No. 1, and the other had received 0.5 c. c. of bacillus No. 4.

From these experiments it was assumed that the serum would protect guinea pigs against four times the minimum fatal dose of these typhoid bacilli. Five pigs were inoculated intraperitoneally with 0.5 c. c. of bacillus No. 1, and two died in twenty-four hours, while the other three died in from four to nine days of experimental typhoid infection. This confirmed the minimum fatal dose as 0.5 of a cubic centimeter.

In order to see whether smaller doses of the serum would protect guinea pigs against the typhoid bacillus No. 1, we injected 0.1 c. c. of serum No. 3 subcutaneously, and in two days these animals were inoculated with doses beginning with 0.5 c. c. of typhoid bacilli and increased to 4 c. c. All died in twenty-four hours except the animals which received 0.5 c. c. and 1 c. c., which survived. This showed that 0.1 c. c. of serum subcutaneously would protect against only twice the minimum fatal dose.

In order to increase the virulence of the laboratory stock culture of the typhoid bacillus, we introduced it inclosed in a celloidin capsule within the peritoneal cavity of a guinea pig, and allowed it to remain there for two weeks. This reduced the minimum fatal dose from 1 cubic centimeter to 0.3 of a cubic centimeter, and this was the most virulent organism which we could obtain. We were compelled therefore to use much larger doses for comparative experiments than Abell and Loeffler, who used bacilli fatal in doses of $\frac{1}{50}$ of a cubic centimeter.

Their experience also showed that if the serum was injected into the peritoneal cavity, that it would protect against larger doses of typhoid bacilli than would subcutaneous injections of serum.

On July 25, 1901, five guinea pigs were given 0.1 c. c. of serum No. 3 intraperitoneally, and in two days these animals were given 0.3-0.5, 0.7-0.8, and 1 c. c. of the bacillus whose minimum fatal dose was 0.3 of a cubic centimeter. All of the animals remained well for two weeks. On August 6, a second series of animals were given a similar dose of serum, and in two days they were given 1 c. c., 1.5 c. c., 2 c. c., 2.5 c. c., and 3 c. c. of the same bacillus. The first two animals survived, showing that 0.1 c. c. of the serum No. 3 would protect against five times the minimum fatal dose of the typhoid bacillus, since this dose was 0.3 of a c. c. Five guinea pigs inoculated with the same doses of bacilli after protection with 0.5 c. c. of serum gave even better results. Only the 2.5 c. c. and 3 c. c. pigs died, showing that 0.5 c. c. of serum injected intraperitoneally will protect against about seven times the minimum fatal dose.

These animal experiments might be summarized by stating that the subcutaneous injection of the serum in doses of from $\frac{1}{600}$ to $\frac{1}{800}$ of the body weight will protect guinea pigs against four times the mini-

mum fatal dose of intraperitoneal injection with the typhoid bacillus. The injection of $\frac{1}{3000}$ to $\frac{1}{4000}$ of the serum by weights, into the abdominal cavity will protect against five times the minimum fatal dose, and a dose of $\frac{1}{600}$ to $\frac{1}{800}$ of the body weight will protect against seven times the minimum fatal dose of the typhoid bacillus.

It was not expected that this serum would exhibit any marked antitoxic properties, but the typhoid bacillus was grown on blood serum and destroyed by a temperature of 60° C. for one hour.

Five guinea pigs were inoculated with 0.3-0.5, 0.8, 1 and 1.2 c. c. of dead bacilli, and the last two animals died in twenty-four hours, while the others survived. The minimum fatal dose was therefore 1 c. c. of dead bacilli. Ten pigs were given 0.5 of serum and were then inoculated with doses of dead bacilli, varying from 0.8 c. c. of the suspension from the blood serum to 2.5 c. c. The two pigs given 2.5 c. c. and one pig given 1.5 c. c. died of toxemia in twenty-four hours, but the seven other pigs which had been given 2 c. c., 1.5 c. c., 1.0 c. c. and .8 c. c. of dead bacilli survived the inoculation. The serum seems to protect against about twice the fatal dose of dead typhoid bacilli.

TREATMENT OF HUMAN CASES WITH SERUM.

Chantemesse (2) has prepared a serum which he calls an antitoxin. He considers that a large amount of toxin is absorbed from the intestines in typhoid fever, and that it should be neutralized by an antitoxin. The toxin is prepared by filtering a fluid culture, and injecting the filtrate into a horse in gradually increasing doses. The serum of the horse in doses of .01 of a cubic centimeter prolonged the lives of guinea pigs injected with the soluble toxin. He injected a human case of typhoid fever with this serum, and thought that he noted some benefit, with a lessening of the temperature.

The serum which we have produced was intended to act against the bacilli themselves. Cole (3) has lately shown that a great many cases of typhoid fever contain the bacilli in the blood current. Can these bacilli be acted upon by the introduction of an artificial serum of high immunizing strength? Experiments upon animals would seem to show that such is the case. Abell and Loeffler gave a number of guinea pigs double the fatal dose of typhoid bacilli, and then after varying lengths of time they treated them with 0.5 c. c. of their protective serum. The animals could be rescued by injections of serum as late as eight hours after infection. After this they died.

Ehrlich, Bordet, Wasserman and others have already clearly shown that the bacteria are destroyed in artificial immunity by the joint action of two distinct substances. One called the intermediate body, or "Zwischenkörper" is produced as an artificial product in the blood

when the animals are injected and immunized by non-fatal doses of various bacteria. It is also called the immune body.

The second substance is called the complement, or "Endkörper," and is a sort of digestive ferment always present in the blood. It is destroyed by a temperature of 60°, while the immune body is not. In order to produce an artificial immunity the immune body and the complement must be both present, and the latter will not destroy bacteria unless the immune body is also present to bind it to the bacterial cells. Both therefore are necessary.

The immune body is apparently the only one action in highly immune serum, and all attempts at serum therapy, including our own, have simply injected serum containing this immune body into the patient. The needful complement or digestive ferment, which dissolves and destroys the bacteria is used up during infection, and we forget to supply this in our zeal to furnish immune serum. Wasserman (4) found that normal bovine serum contained the complement necessary for the immune body to prevent infection in guinea pigs. Animals inoculated intraperitoneally with three loopfuls of a virulent typhoid organism and then protected only with 0.5 c. c. of an immune serum died with general infection. If similar doses of typhoid bacilli and serum were given to other animals and 4 c. c. of normal serum of a cow was also injected, the animals lived. This showed that the cow's serum supplied the complement, which the immune body could act upon, forcing the complement of the cow's serum to destroy the bacteria.

Mark Richardson (5) has verified this principle of Wasserman's by a most interesting series of observations on the digestive properties of the serum of typhoid patients towards typhoid bacilli. He found that if he added a loopful of typhoid bacilli to the serum of a typhoid fever patient that no digestion of bacteria took place, and in twenty-four hours two thousand colonies grew from the mixture. The complement was absent during the disease, and therefore no destruction of the bacilli took place. If, however, he first added his own healthy blood to the typhoid blood he supplied the missing complement. When a loopful of typhoid bacilli was added to this mixture the result was far different. In two hours the bacilli were almost all dissolved and digested into small granules, and in twenty-four hours a plate from the mixture only showed one colony.

These experiments are a clear indication that a normal serum containing a complement reacting to the immune body, is quite as important in typhoid fever as a highly immune serum.

RESULT OF TREATMENT.

Up to the present time we have treated only five cases of typhoid fever with this serum, and it would be useless to attempt to draw any

conclusions from such a small number of cases. Yet it may be of some interest to briefly mention a few points concerning these patients.

Cases No. 1 and 2 were treated at the Johns Hopkins Hospital through the kindness of Dr. Osler. It can not be said that the doses of serum given had any appreciable effect upon the temperature, pulse, or other symptoms.

In case No. 1 the serum treatment was begun on the thirteenth day and continued for five days in doses of from 10 to 20 cubic centimeters at each injection. Sixty-five cubic centimeters was used in treating this case. The patient ran an even temperature of from 102° to 104° and the temperature reached normal on the twenty-eighth day of the disease. The case pursued a mild course.

In case No. 2 one hundred and twenty cubic centimeters were injected in doses of 20 c. c. for six days. The injections were begun on the ninth day. The temperature varied from 101° to 103° and reached normal on the twenty-second day. On the twenty-seventh day a relapse occurred which only lasted ten days. This case also ran a mild course.

Cases No. 3, 4 and 5 seemed to show some improvement after the serum treated. Case No. 3 started out with a temperature of from 103° to 104°, and on the seventh day the serum was injected. Two hundred c. c. were injected, 40 c. c. being used in two injections daily . This caused no harmful symptoms, and the urine remained normal. The temperatures began to steadily decline after the first injection and reached normal on the seventeenth day. Case No. 4 pursued a similar course, and reached normal on the fourteenth day. Sixty-four c. c. of serum were used in this case .

Case No. 5 was a case of typhoid fever with pregnancy, in which the woman aborted at six and a half months during the fever. The urine contained albumen and casts during the entire attack. Before the administration of the serum the temperature ranged from 103° to 106.5°, but on the sixth day after going to bed 10 cm. of serum were given, and similar doses were given for six days. Soon after the first injection of the serum the temperature began to fall, and on the fourteenth day it reached normal. After that the patient made an uneventful recovery.

All of these cases treated showed few if any other symptoms except fever, but it will take many more cases to show whether the use of a serum of a high immunizing strength is alone of any benefit in typhoid fever.

CONCLUSIONS.

It is not difficult to produce a serum of high agglutinative strength and immunizing power by injecting the hog with pure typhoid cultures.

Although little can be learned from five cases, the use of this serum seemed to produce a slightly favorable effect in three cases.

We are preparing more serum and hope to use it in combination with the normal serum of various animals.

LITERATURE.

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TABLE NO. 1.

July 24, 1900.

Pig inoculated with 10 c. c. of bouillon twenty-four hour culture of No. 16 Hopkins typhoid bacillus; 1 c. c. of which killed a guinea pig in twenty-four hours, the bacillus being recovered from the liver and abdominal cavity. Bacillus used from liver.

Date.		Dose of Bacilli.		Temperature.
July	24th, 1900	10 c. c.		41°
	27th, "	100 "		41°
	30th, "	110 "		41°
Aug.	4th, "	130 "		
	24th, "	150 "		39.5°
	25th, "			39.8°
	28th, "			40°
	29th, "	200 "		40°
	30th, "			39.5°
	31st, "			39.8°
Sept.	1st, "	250 "		39.5°
	3d, "			40°
	15th, "	300 "		40.5°
Oct.	4th, "	650 "		
	5th, "			40°
	7th, "			40°
	10th, "			39.5°
	20th, "	200 "		
	21st, "			40°
Nov.	1st, "	800 "		
	26th, "	1000 "		
	28th, "			40°
Dec.	14th, "	1000 "		
Dec.	31st, "	1100 "		
Feb.	15th, 1901	500 "		
	27th, "	Bled, 200 "	serum obtained.	
March	14th, "	500 "		
	21st, "	Bled, 200 "	serum obtained.	
April	5th, "	Bled, 200 "	serum obtained.	
May	1st, "	500 "		
	15th, "	Bled, 250 "	serum obtained.	Died.

TABLE NO. 2, AGGLUTINATION EXPERIMENTS.

Record of Widal tests in pig injected with cultures of the typhoid bacillus.

Date of Test.			Result.	Dilution.
Aug. 22d, 1900			+	1-100
22d,	"		+	1-500
22d,	"		+	1-1000
22d,	"		O	1-2000
22d,	"		O	1-5000
22d,	"		O	1-10000
29th,	"		+	1-1000
29th,	"		O	1-1500
29th,	"		+	1-2000
Sept. 15th,	"		+	1-1500
15th,	"		+	1-2000
15th,	"		Slight	1-3000
15th,	"		Slight	1-4000
Oct. 16th,	"		Slight	1-3000
16th,	"		O	1-4000
Nov. 1st,	"		+	1-3000
1st,	"		+	1-4000
13th,	"		+	1-4000
13th,	"		+	1-5000
13th,	"		+	1-6000
13th,	"		+	1-7000
20th,	"		O	1-8000
20th,	"		O	1-9000
Dec. 4th,	"		+	1-7000
4th,	"		+	1-8000
15th,	"		+	1-9000
15th,	"		+	1-10000
March 13th, 1900			+	1-14000
13th,	"		+	1-15000
13th,	"		+	1-16000
13th,	"		+	1-17000
13th,	"		+	1-20000
21st,	"		+	1-22000
21st,	"		+	1-24000
21st,	"		+	1-26000
21st,	"		+	1-28000
21st,	"		+	1-30000
28th,	"		+	1-32000
28th,	"		+	1-34000
28th,	"		+	1-36000
28th,	"		+	1-38000
28th,	"		+	1-40000
April 12th,	"		+	1-45000
12th,	"		Slight	1-50000
12th,	"		Slight	1-55000
16th,	"		O	1-60000
12th,	"		Slight	1-65000
13th,	"	(Serum No. 2)	+	1-15000
13th,	"		+	1-20000
13th,	"		+	1-25000
13th,	"		+	1-30000
13th,	"		O	1-35000
May 1st,	"	(Serum No. 3)	+	1-15000

Table No. 3, Showing Animal Experiments.

No. of Guinea Pig.	Dose of Serum No. 3.	Dose of Typhoid Bacillus.	Died.	Result of Autopsy.
1.....		1 c.c. bouillon culture	No	
2.....		1 " "	"	
3.		1 " "	"	
4.....		1 " "	"	
5.....		1 " "	"	
6.		1 " "	"	
7.....		1 " "	"	
8.....		2 c.c. suspension from serum Bacillus No. 1.....	Yes, 24 hrs.	Purulent peritonitis, General septicemia.
9.....		2 " " " " 1.....	" "	Purulent peritonitis, General septicemia.
10.....		2 " " " " 2.....	No	
11.....		2 " " " " 2.....	"	
12.....		2 " " " " 3.....	"	
13.....		2 " " " " 3.....	"	
14.....		2 " " " " 4.....	Yes, 24 hrs.	Purulent peritonitis, General septicemia.
15.....		2 " " " " 4.....	" "	Purulent peritonitis, General septicemia.
16.....		2 " " " " 5.....	No	
17.....		2 " " " " 5.....	"	
18.....		2 " " " " 1.....	Yes, 24 hrs.	Purulent peritonitis, General septicemia.
19.....		2 " " " " 1.....	" "	Purulent peritonitis, General septicemia.
20.....	1 c.c. Subcutaneous ..	2 " " " " 1.....	No	
21.....	1 " " ..	2 " " " " 1.....	"	
22.	1 " " ..	2 " " " " 1.....	"	
23.....	1 " " ..	2 " " " " 4.....	"	
24.....	1 " " ..	2 " " " " 4.....	"	
25.....	1 " " ..	2 " " " " 4.....	"	
26.....	0.5 " " ..	2 " " " " 1.....	"	

TABLE NO. 3, SHOWING ANIMAL EXPERIMENTS.—*Continued.*

No. of Guinea Pig.	Dose of Serum No. 3.	Dose of Typoid Bacillus.	Died.	Result of Autopsy.
27	0.5 c.c. Subcutaneous	2 c.c. suspension from serum Bacillus No. 1	No	
28	0.5 " "	2 " " " " 1	"	
29	0.5 " "	2 " " " " 4	"	
30	0.5 " "	2 " " " " 4	"	
31	0.5 " "	2 " " " " 4	"	
32		1 " Bacillus No. 1	Yes, 24 hrs.	Purulent peritonitis, General septicemia.
33		1 " " " 1	Yes, 48 hrs.	Purulent peritonitis, General septicemia.
34		0.5 " " " 4	Yes, 24 hrs.	Purulent peritonitis, General septicemia.
35		0.5 " " " 1	Yes, 24 hrs.	Purulent peritonitis, General septicemia.
36		0.5 " " " 1	Yes, 24 hrs.	Purulent peritonitis, General septicemia.
37		1 " " " 4	Yes, 36 hrs.	Purulent peritonitis, General septicemia.
38		1 " " " 4	Yes, 24 hrs.	Not autopsied.
39		0.5 " " " 4	Yes, 48 hrs.	Not autopsied.
40		0.5 " " " 4	Yes, 24 hrs.	Purulent peritonitis, General septicemia.
41		0.5 " " " 4	Yes, 24 hrs.	Purulent peritonitis, General septicemia.
42		0.5 " " " 1	Yes, 24 hrs.	Purulent peritonitis, General septicemia.
43		0.5 " " " 1	Yes, 24 hrs.	Purulent peritonitis, General septicemia.
44		0.5 " " " 1	Yes, 5 days	No autopsy.
45		0.5 " " " 1	Yes, 9 days	No autopsy.
46		0.5 " " " 1	Yes, 4 days	No autopsy.
47	0.1 c.c. Subcutaneous	0.5 " " " 1	No	
48	0.1 " "	1.0 " " " 1	"	

49.....	0.1 c.c. Subcutaneous..	1.5 c.c. Bacillus No. 1.....	Yes	Purulent peritonitis, General septicemia.
50.....	0.1 " " ..	2.0 " " " 1.....	"	Purulent peritonitis, General septicemia.
51.....	0.1 " " ..	2.5 " " " 1.....	"	Purulent peritonitis, (No cultures).
52.....	0.1 " " ..	3.0 " " " 1.....	"	Purulent peritonitis, (No cultures).
53.....	0.1 " " ..	3.5 " " " 1.....	"	Purulent peritonitis, General septicemia.
54.....	0.1 " " ..	4.0 " " " 1.....	"	Purulent peritonitis, General septicemia.
55.....		1 c.c. Bacillus fr. capsule to increase virulence..	"	Purulent peritonitis, General septicemia.
56.....		0.5 " " " " ..	"	Purulent peritonitis, General septicemia.
57.....		0.3 " " " " ..	"	Purulent peritonitis, General septicemia.
58.....		0.2 " " " " ..	No	
59.....		0.1 " " " " ..	"	
60.....	0.1 c c. Intraperitoneal.	0.3 " " " " ..	"	
61.....	0.1 " " .	0.5 " " " " ..	"	
62.....	0.1 " " .	0.7 " " " " ..	"	
63.....	0.1 " " .	0.8 " " " " ..	"	
64.....	0.1 " " .	1.0 " " " " ..	"	
65.....	0.1 " " .	1.0 " " " " ..	"	
66.....	0.1 " " .	1.5 " " " " ..	"	
67.....	0.1 " " .	2 " " " " ..	Yes, 48 hrs.	Purulent peritonitis, General septicemia.
68.....	0.1 " " .	2.5 " " " " ..	Yes, 24 hrs.	Purulent peritonitis, General septicemia.
69.....	0.1 " " .	3 " " " " ..	Yes, 24 hrs.	No autopsy.
70.....	0.5 " " .	1.0 " " " " ..	No	
71.....	0.5 " " .	1.5 " " " " ..	"	
72.....	0.5 " " .	2.0 " " " " ..	"	
73.....	0.5 " " .	2.5 " " " " ..	Yes	Purulent peritonitis, General septicemia.
74.....	0.5 " " .	3.0 " " " " ..	"	No autopsy.
76.....		0.3 " Dead bacilli	No	

TABLE NO. 3, SHOWING ANIMAL EXPERIMENTS.—*Concluded.*

No. of Guinea Pig.	Dose of Serum No. 3.	Dose of Typhoid Bacillus.	Died.	Result of Autopsy.
77		0.5 c.c. Dead Bacilli	No	
78		0.8 " "	"	
79		1.0 " "	Yes	Focal necroses, general congestion. Fatty degeneration.
80		1.2 " "	"	Focal necroses, general congestion. Fatty degeneration.
81	0.5 c.c.	0.8 " "	No	
82	0.5 "	0.8 " "	"	
83	0.5 "	1.0 " "	"	
84	0.5 "	1.0 " "	"	
85	0.5 "	1.5 " "	Yes	Focal necroses, enlargment of spleen.
86	0.5 "	1.5 " "	No	
87	0.5 "	2.0 " "	"	
88	0.5 "	2.0 " "	"	
89	0.5 "	2.5 " "	Yes	Focal necroses, enlarged spleen, general congestion.
90	0.5 "	2.5 " "	"	No autopsy.

ABSTRACT OF A PAPER ENTITLED "DEMONSTRATION OF THE EXISTENCE OF TYPHOID FEVER IN THE CITY OF MEXICO BY THE WIDAL METHOD."

By ANGEL GAVINO, M. D.,

Chief of the Bacteriological Section, Pathological Institute, City of Mexico, Mexico.

The author states that the reasons why typhoid fever and its diagnosis by the Widal reaction has not been studied in the City of Mexico, are as follows:

During the author's experience as a student, practitioner and investigator, cases having the typical picture of typhoid fever have not been seen, and autopsies have never shown the typical typhoid lesions of the intestinal mucous membrane.

In the author's experience he has seen but one suspicious case. Cases of remittent fever, generally taken by the profession to be paludic in origin, the author found on blood examination not to be such. The author began investigations of such cases by the use of the serum reaction in 1896. Four cases gave negative results. The writer later studied twelve cases, three of which gave negative results although one was clinically typhoid; the other nine cases gave positive reactions in dilutions of from one to thirty to one to sixty.

The author considers the probability of there being a slight epidemic, the cause of which he ascribes at present as follows:

"From the colonial period, the City of Mexico has always received its drinking water from two main sources; the first, which is called "Agua Dulce," is of six to seven hydrotimetric degrees, and comes from the Desierto de los Leones, situated nine hundred meters above the city. This water supplies the northern half of the city. The second source of supply is the spring at Chapultepec, four kilometers from the city, and that will hardly rise through the iron piping after having been raised by pumps into the reservoirs, a height of twenty-five meters. This water is very soft and is twelve degrees by the hydrotimeter. The waters from this spring supply the southern part of the city.

"The waters coming from the first of these two sources, have lately been increased by those which come from Morales and Rio Hondo, which are not well matched and do not run through piling the whole way. The waters from these three sources supply the northern half of the city. The cases in which we have been able to obtain the Widal

agglutination, were all without exception, residents of the northern part of the city. This might be a simple coincidence; but taking into account the hydric source of typhoid fever, I believe we have a perfect right to suspect the waters of the new springs, seeing that the hospital and private clinics of the city, formerly found only an odd case here and there, whilst nowadays they are found in greater frequency and confirmed by bacteriologists.

"Finally, I would say, that without being able to present a complete study which I am now carrying on with the members of the Pathological Institute of Mexico, of the waters of the city, I can assure you that the waters from the Chapultepec spring carry very few germs originally but in the city piping they have a great many. These waters are always better than those of Los Leones, Rio Hondo and Morales, which contain enormous numbers of bacteria in the city pipes, including many colon bacilli, revealing the existence of fecal matter in those waters."

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METHODS OF DIAGNOSIS IN GLANDERS.

FROM THE BOSTON BOARD OF HEALTH BACTERIOLOGICAL LABORATORY.

By HIBBERT WINSLOW HILL, M. D., and
ALEXANDER BURR, D. V. M.

The Boston Board of Health is charged with the detection, supervision and destruction of glandered horses. Since glanders is somewhat prevalent in Massachusetts, this work assumes considerable importance, not only because it affects the horses as property, but also because of occasional transmission of the disease to the human subject, in which is it almost invariably fatal, at least in the recognized cases. About five such human cases occurred in Massachusetts in 1899 and 1900.

The diagnosis of glanders may be made by clinical methods, by guinea pig inoculation, by the injection into the horse of mallein, and of course by autopsy, followed by bacteriological tests. It is the object of this paper to outline briefly the first three methods, and to point out so far as may be the range of application, their defects and their comparative value in practice.

It has seemed worth while to present these results here, although previously published more briefly in reports of the Boston Health Department, 1898, etc., because they illustrate well the kind of work which is necessary in order that the true value of any one of the bacterial methods now relied upon in this and other diseases may be determined. The results here presented are particularly valuable for statistical purposes because they were obtained practically by one investigator, thoroughly familiar with each form of diagnosis, having the animals constantly under observation until a diagnosis was reached and able to conduct autopsies whenever necessary. Similar investigations in diphtheria, tuberculosis, etc., are more or less hampered by the fact that different men, clinicians, bacteriologists, pathologists, usually perform different parts of the whole, that the cases may disappear from observation and that autopsies can not always be obtained when wanted. This is especially true of public health work, while in hospitals other factors come into play, the material being largely severe or advanced cases. It is therefore difficult to estimate percentage accuracy of results and to ascribe discrepancies and irregularities always to their proper sources, although if very large numbers of cases are considered, individual in accuracies may be supposed to mutually eliminate each other.

CLINICAL DIAGNOSIS.

Glanders[1] occurs in animals as an acute or chronic disease. The usual form seen is the chronic.

Glanders occurs clinically in horses, mules, and asses. It occurs in man probably by transmission from animals affected with glanders. Cattle appear to be immune.

In acute glanders there is marked constitutional and functional disturbance, with intense fever, often running as high as 105° or 106°, which lasts for a number of days. There is rapid emaciation, frequent chills, and perhaps lameness without any apparent cause, followed by œdema of the extremities. While in this stage, which lasts two to four days, the diagnosis is very difficult to make. Soon the fever begins to diminish, and is followed by local lesions. Glanders nodules appear on the nasal septum, which rapidly soften, causing more or less discharge, and leaving a deep, ragged-edged ulcer. The disease in a short time becomes general in the lungs and lymphatic glands, with intense inflammation of the synovial membranes of the joints. Fever now begins to increase again, cheesy deposits in the lungs become extensive, and death follows, in from one to two weeks.

Chronic glanders probably always begins with a slight acute attack of glanders, which is not recognized as such, probably being diagnosed as a slight coryza, or an attack of lymphangitis. In fact, the history often obtained in chronic glanders is that the animal has had a number of attacks of lymphangitis, which readily yielded to treatment, the horse returning to work and continuing for some time in good condition.

Chronic glanders may continue for months and even years before definite symptoms, such as typical ulcerations of the mucous membrane of the nose or the subcutaneous tissues, appear to warrant the making of a positive diagnosis.

The usual symptom of chronic glanders is a nodular condition of the mucous membrane of the nose, generally on the nasal septum. These nodules vary in size from a pin head to that of a pea. Later these nodules ulcerate, leaving a raw surface, which has a raised irregular edge. Several ulcers may run together, forming a large one. There is very little tendency in these ulcers to heal. They continue to discharge a thick, gluey, muco-purulent discharge, which adheres to the external edges of the nose. There is no odor, excepting when necrosis of the bone occurs. Occasionally they heal, leaving a rough, drawn scar.

[1] The term "glanders" is applied to this disease when the external lesions are present in the nasal mucous membrane and adjacent lymphatic glands, as the submaxillary gland. The term "farcy" is applied to this disease when the external lesions appear as ulcers in the skin, accompanied by a nodular condition of the superficial lymphatics. The existence of the two terms, "glanders" and "farcy," is misleading, since they are often considered to mean two distinct diseases. It is much better to speak of the disease as glanders, without regard to location.

One or both of the submaxillary glands are usually enlarged, hard and nodular, more or less adherent to the inferior maxilla, and with very little tendency to suppurate. Lymphatic glands all over the body may become enlarged. Nodules followed by ulceration may appear upon any part of the skin, usually the legs. The discharge from ulcers upon the leg is usually a semi-translucent, thick, amber-colored pus, but sometimes occurs as a clear serum.

With one or both submaxillary glands enlarged, nasal discharge, and typical ulceration of the nasal septum, the diagnosis is clear. Cases, however, are frequently met with where the only lesion to be seen is an enlarged submaxillary gland, others where only a slight nasal discharge is present, and still others where the only lesion is an ulcer of the skin. In these, a clinical diagnosis cannot be made except by waiting until the disease develops further.

MALLEIN DIAGNOSIS.

Preparation of Mallein. Ordinary nutrient broth (Bact. Com. A. P. H. A.), to which has been added five per cent. of pure redistilled glycerine, is used. The reaction is adjusted to + 15 (1.5 per cent. acid) and the broth is then sterilized in litre flasks, about 400 to 500 c. c.'s in each flask, and incubated at 37° C. for three days to test sterility.

B. mallei, grown on plain nutrient agar at 37° C. for forty-eight to seventy-two hours, is inoculated into each flask, preferably by rubbing the loopful of bacilli on the inside of the flask wall at the upper level of the broth, in order to secure the formation of a surface pellicle. Melted paraffin is then poured on the surface of the cotton plugs after burning them down to the level of the flask mouth, and the flasks are incubated at 37° C. for four to six weeks. The surface pellicle should begin to develop in two or three days, but sometimes requires a week or ten days. It appears as a white, moist, opaque viscid mass at the edge of the upper level of the broth, which by that time is cloudy with the growth of the bacilli. It develops by extension from this mass, or sometimes by detached islands of membrane floating on the surface. These are flat and semi-transparent, resembling films of paraffin at first, but soon increase in diameter and become whitish, opaque and wrinkled, simulating somewhat the surface pellicle formed by *B. subtilis*. At the end of the period specified most of the membrane has usually disappeared, breaking up and settling to the bottom of the flask.

The flask cultures are then weighed, concentrated by boiling to one-half the original weight, cleared by adding white of egg, filtered through a porcelain or Berkefeldt bacterial filter, sterilized, filled into sterilized bottles containing one or two c. c.'s each and again sterilized.

They are then ready for use. One-half per cent. of carbolic acid may be added as a preservative.

The writer uses addition of white of egg, as an emulsion, during the concentration, for clearing the culture. It is effective, makes the subsequent filtration very much easier and does not appear to have any disastrous effect on the mallein.

Method of Making Mallein Test. Having, by previous examination[1] ascertained what the ordinary temperature of the suspected animal is, a subcutaneous injection of mallein is made in the thick portion of the neck. The reaction to mallein consists in a high rise of temperature with more or less swelling at the point of injection. The rise in temperature occurs usually in from six to eight hours, requiring the temperature to be taken within about six hours, and again thereafter about every three hours. A swelling at the point of injection is always present; but, if glanders is present, it is large, well marked, with abrupt edges. If glanders is not present, the swelling is small and flat. The results, where a reaction has taken place, usually runs somewhat as follows. Temperature at time of injection, 10 p. m., 101°; 5 a. m., 104°; 7 a. m., 105°; 9 a. m., 105°; 11 a. m., 105°; 5 p. m., 105°; in forty-eight hours, probably back to 102°. During the test, no water is allowed, but food is given as usual.

The following table shows the relation between the temperature reaction and the reaction (swelling) at the point of injection during the mallein test.

TABLE No. I.

Temperature Reaction.		Reaction at Point of Injection.	
		Typical.	Atypical.
Positive	45	38	7
Negative	29	1	28
Doubtful	5	2	3
Total	79	41	38

The following standards of reaction have been used in all records, tables, etc., relating to the mallein tests in this article:

1. If the rise in temperature is 1° or less the reaction is negative unless the temperature before testing is 104° or more. (See below, 4.)

[1] For the best results, the ordinary range of temperature of the horse should be determined by test at intervals of three hours extending over one day, or better still, one week. This is seldom possible in practice, and these records are treated on an initial temperature immediately before injection.

2. When the temperature before testing is not above 102° and during the test reaches 104° or more, the reaction is positive; but if, during the test, the temperature does not reach 104° (the rise, however, being more than 1°) the reaction is doubtful.

3. When the temperature before testing is between 102° and 104° and, during the test, rises 2° or more, the reaction is positive, but if the rise is less than 2° (and more than 1°) the reaction is doubtful.

4. If the temperature before testing is 104° or more, the test is of no value, since it is impossible to recognize whether the reaction is positive, negative, or doubtful.

These standards were used up to 1901. It was then decided on the basis of further evidence obtained to modify them. The change consists in no longer recognizing as negative any reaction obtained when the initial reaction is above 102°, but classes all such as either positive or doubtful. When the initial temperature is below 102°, the reactions obtained are recognized as positive, doubtful or negative. These changes do not, however, affect the records already obtained and here presented.

GUINEA PIG DIAGNOSIS.

(Strauss Method.)

Occasionally a direct microscopic examination of the material obtained from the suspected horse will show an organism which is "indistinguishable from the glanders bacillus." A diagnosis can rarely if ever be made by this method, since the glanders bacillus presents no morphological characters so distinctive as to permit of its absolute recognition under the microscope alone. In some cases a direct inoculation on potato from the lesion will result in the development of typical glanders colonies. This is a reliable method if the glanders bacillus be isolated, but unfortunately rarely succeeds in practice.

More often an ordinary cotton swab, such as is used in diphtheria swabs, is used to collect the discharge from the lesion suspected.

The swab is transferred to 5 c. c.'s of sterilized water and shaken thoroughly in it and the resulting suspension is inoculated intra-abdominally into well-grown male guinea pigs. A mixture of organisms is usually thus introduced into the peritoneal cavity, especially if the preparation comes from the horse's nose. This mixture may or may not contain the glanders bacillus. If the glanders bacillus is not present, nor any other pathogenic organism in sufficient numbers or of sufficient virulence to produce death, the guinea pig, after a few hours or days of depression, recovers completely. If acute septic organisms be present in the injected liquid, the guinea pig is likely to die within twenty-four hours, whether the glanders bacillus be present or not, before the glanders lesions have time to develop. In such cases the test is evi-

dently of no value, and should be repeated. If the glanders bacillus be present, and the other organisms also present fail to kill, the typical scrotal lesions or the peritoneal lesions will develop, the former usually within twenty-four to seventy-two hours, the latter later on.

Under the conditions of this test, when used for diagnosis, it is well to isolate the glanders bacillus from the lesions before giving a final positive diagnosis. It is especially desirable to do so if only peritoneal lesions are found. If lesions are found anatomically atypical, a negative diagnosis should be withheld until cultures have been obtained. This for the reason that in one positive case the only lesions found were two nodules, one on each side, in the peritoneum overlying the spermatic vessels at their entrance to the scrotum, swelling and adhesion of the testicles being absent, but the glanders bacillus being present. Even when the guinea pig dies of acute peritonitis it may sometimes be possible to isolate the glanders bacillus from the mixture found in the peritoneal cavity. On the other hand, a swelling and adhesion of one testicle may occur, due to organisms other than the glanders bacillus.

The lesions found are most commonly nodular deposits in the visceral layer of the *tunica vaginalis*, which, in the guinea pig is continuous with the peritoneum. The nodules extend into the testicle and also to the outer layer of the *tunica*. The testicle enlarges, and, as a result of this enlargement and of the formation of the nodules, becomes adherent in the sac, in sharp contrast with the condition in health, when the testicle may readily be pushed upward into the peritoneal sac of the abdomen. Infiltration of the scrotal tissues, with œdema sometimes extending into the groin and the supra-pubic region, are also found. Sometimes only one testicle is extensively affected and adherent.

In one guinea pig lesions of the skin presenting the bacillus and simulating those of "farcy" in the horse were found.

Other lesions are often not evident, especially when the guinea pig is killed early, as is usual in this service. Sometimes, however, nodular deposits in the peritoneum, omentum, mesentery, liver, spleen, lungs, and lymphatic glands are found in the male, generally with scrotal lesions, but sometimes without. In the female the lesions are the same, omitting the scrotal lesions. According to Wright (Journ. Expt. Med., Vol. I., No. 4, Nov., 1896,) the process resulting in a nodule is a primary necrosis, due to the glanders bacillus, followed by imflammatory exudate, often suppurative.

The glanders bacillus[1] may be detected in the nodules, mounted direct. It is a short, thick rod, with rounded ends, usually slightly curved or bent, sometimes elongated in a thread form. It stains only faintly with Löffler's methylene blue, and often shows unstained spaces within its outline. Transfer of a portion of a nodule to potato at 37° C. results in the development within twenty-four to forty-eight hours of small, smooth, glistening, amber-colored colonies, increasing slowly in size and depth of color. If the potato is very moist the color develops very slowly. The bacillus obtained from these colonies resembles more or less the form presented in the nodules, but on potato, as on other media (agar, broth, gelatin, etc.), the morphology is variable.

The following table indicates the length of time elapsing between inoculation of the guinea pig and development of recognizable lesions due to the glanders bacillus:

1 day	2	guinea	pigs	5 days	6	guinea	pigs
2 days	15	"	"	5 days	3	"	"
3 days	23	"	"	7 days	2	"	"
4 days	18	"	"	8 days	1	"	pig

Hence a guinea pig should survive eight days after inoculation without lesions, before being recorded as yielding a negative test. When peritonitis occurs, death follows in one day (29 pigs), two days (14 pigs), three days (5 pigs), or four days (2 pigs).

It must be remembered that lesions not glanders may be found in glandered horses; thus occasionally an ulcer or abscess may yield negative results, while the nose is positive.

In comparing these tests with each other, the one point which can be fixed definitely is the final conclusion, when the latter is *positive*. Such a conclusion in the cases under consideration is based upon positive guinea pig tests (including always the recovery of *B. mallei* from the guinea pig), or an autopsy yielding results typical of gland rs or both. No case is yet recorded where virulent glanders bacilli were found in a healthy horse. Non-virulent glanders bacilli, if present, would not be discovered by the test used so that on this point evidence is lacking. Hence the cases reported as finally positive may be accepted as having had the disease without question. The cases recorded as finally negative may include a few animals in which the disease was latent, in spite of repeated tests and prolonged watching. They form, however, a class almost as reliable as that of the positives. The cases finally doubtful can of course furnish no definite information.

[1] On account of the occasional presence of branched forms, and the tendency of the organism to produce nodules in the living tissues, there is some reason to classify this "bacillus" with those of tuberculosis and actinomycosis.

REPEATED TESTS.

The value of repeated guinea pigs tests varies with the case in hand but is always worth trying. Out of sixty-eight finally yielding positive guinea pigs, sixty-two were positive on the first attempt, three on the second, three on the third, the previous tests on these repeated ones being negative or unsatisfactory. Nasal discharges produce peritonitis in 28 per cent. of the total guinea pigs injected from this source, while only a little over 5 per cent. of injections from all other sources resulted thus. Repeated mallein tests are not of much value, unless the first be doubtful, for a negative result is almost never followed by a positive. It is scarcely necessary to say that clinical examinations should be repeated frequently in doubtful cases.

SUMMARY AND CONCLUSIONS.

Cases examined clinically fall into the following classes:

1. Cases undoubtedly glanders clinically; requiring no further tests.
2. Cases undoubtedly not glanders clinically; requiring no further tests.
3. Cases probably positive, but in which some doubt exists.
4. Cases probably negative, but in which some doubt exists.
5. Cases in which the clinical evidence is nicely balanced.
6. Cases negative clinically, but definitely exposed to infection, as the working mate of a glandered horse.

It is the latter four classes which call for mallein or guinea pig tests or both. Despite the use of the best clinical judgment, and free use of both tests, cases are sometimes found which must simply be kept under observation until further developments occur. For example, a horse negative clinically, yielding a positive mallein reaction and a doubtful or even negative guinea pig test, must sometimes be isolated and watched, especially where exposure to infection is evident. Still more troublesome is the decision in a clinically doubtful or even clinically positive horse giving a doubtful mallein reaction and a negative or doubtful guinea pig test. But usually a decision can be reached within a week in some way or other. Taking 100 cases representing classes 3, 4, 5 and 6, which finally proved to be glanders, the three methods of diagnosis as employed on the case when first under observation may be compared with each other on the basis of the results given.

TABLE No. II.

Total positive cases.	*Clinical*			*Mallein*			*Guinea pig*		
	+	—	?	+	—	?	+	—	?
100	51%	5%	44%	96%	0%	4%	77%	8%	15%
Total negative cases.	+	—	?	+	—	?	+	—	?
100	11%	53%	36%	14%	75%	11%	0%	71%	29%

This table indicates that clinical methods succeed in detecting only about one-half the finally positive cases, and one-half the finally negative cases.

The mallein reaction is never negative in the presence of glanders.

The guinea pig test is never positive in the absence of glanders.

Only these two forms of results are constantly reliable—the positive guinea pig and the negative mallein.

The positive mallein and the negative guinea pig can not be relied on absolutely.

Of the total positive mallein reactions, 87 per cent. only corresponded with the presence of glanders.

Of the total negative guinea pig reactions, 90 per cent. corresponded with the absence of glanders.

But it is of course impossible to say until the end of any given case, what weight should be allowed to the positive mallein alone or the negative guinea pig alone as obtained in practice, although the figures given indicate the weight which may be allowed to these reactions in combination with the other indications which may be available.

THE VIABILITY OF THE PLAGUE BACILLUS IN ITS RELATIONS TO THE PUBLIC HEALTH.

By M. J. ROSENAU, Passed Assistant Surgeon, Director Hygienic Laboratory, Marine Hospital Service, Washington, D. C.

The conclusions which I am about to present to you are the results of about two years of work with the plague bacillus in the Hygienic Laboratory of the Marine Hospital Service. We worked with specimens from seven sources: Djiddah, Arabia; Oporto, Rio de Janeiro, Bombay, the New York quarantine case, Glasgow and San Francisco.

The increase of our knowledge of the life history of the plague bacillus has been a strong weapon in the hands of sanitarians, health and quarantine officers, in preventing the spread of the disease.

We found that there are many factors that influence the life of the bacillus pestis in the outer world. Some of these influences, such as temperature, moisture, and light, are well understood. The bacillus withstands drying very badly. It can not live long in the direct, warm sunshine. High temperatures are invariably fatal. There are other less well understood conditions which affect the life of this organism.

In the light of our experiments and the published work of others we have to modify considerably our views upon the viability of the bacillus pestis. It does not always and under all circumstances die in so short a time as a few days, as the work of Kitasato and Wilm first indicated. We now know that the organism may live for months, and even years, in a test tube, on a moist albuminous medium. And our work shows that even when dry it may live over four months, provided the temperature is cool—less than 20° C.

The bacillus of plague can in no sense be considered a tender organism, as was at first supposed. It is much easier to cultivate than the lanceolate coccus of pneumonia or the pathogenic streptococci. In this respect it resembles more closely the hardier of the hemorrhagic septicæmic group.

We tested the life history of this organism upon a great variety of objects and under various conditions. We attempted to imitate nature. But we can not imitate all the conditions under which the organism may exist in nature, and we ought not, therefore, to apply the experience of the laboratory too literally to the life history of the plague bacillus outside of the body. We may determine with fair certainty the length of time the bacillus may live under given conditions. But these conditions are more or less arbitrary, and to a certain extent

artificial. In general terms, we can state whether it is a hardy organism, resistant to influences usually detrimental to bacterial life, or one that loses its virulence and dies quickly when removed from its natural habitat.

The bacillus of plague does not exist in nature on sterile glass cover slips, nor yet in the dessicator over concentrated sulphuric acid, which were conditions used by some authors who have reported their results on this question.

It is also necessary to call attention to certain conditions which obtained in most of these experiments, that are very far from the usual state of affairs.

The test objects were very abundantly inoculated with a pure culture of the bacillus pestis of known activity and virulence. Often the test objects were saturated. The cultures had been grown for a long time upon artificial media in the laboratory, so that their vitality was probably strongly influenced. It is a well known fact that virulent pathogenic bacteria may at first grow very poorly upon the ordinary laboratory media, but by successive cultivation they become accustomed to the new conditions, so that they finally thrive abundantly; that is to say, they take on a sort of saprophytic existence. Such cultures would doubtless resist the various influences to which they are exposed in the laboratory tests better than another race direct from the blood or tissues. In fact, it is found that the plague bacillus in the blood and tissues from a rabbit usually dies out rather quickly when dried upon the test objects. On the contrary, bouillon cultures dried on similar objects and under similar conditions live a much longer time.

Another departure from normal conditions was the fact that all the test objects receiving the abundant inoculations of the virulent pure cultures were sterile. In other words, not only were cultures of the bacillus used that were accustomed to a saprophytic existence, but these cultures were placed upon sterile test objects and protected against contamination, so that they were relieved from that microbial symbiosis which, in the economy of nature, plays so important a part in the suppression of pathogenic micro-organisms. It is known that in organic mixtures the hardier saprophytes tend to overpower the bacillus pestis. This even occurs to a certain extent in the blood and buboes of patients sick of the disease, as well as in dead organic infusions. The bacillus pestis is not known to have synergists among the lower forms of life. But that such exist may well be inferred from analogy.

Further, different races of the plague organism certainly have different powers of resistance to unfavorable influences. Some races of plague are hardier than others, just as some races of mankind are

hardier than others. Batzeroff states: "There undoubtedly exist varieties that attenuate very quickly and die outside the living body in a relatively short time. There are other varieties that retain their viability under similar conditions a long time." Bacteria show even a stronger tendency to adaptability than the higher animals. They may become accustomed to influences by a gradual survival of the fittest so that they finally resist conditions that would be fatal to the parent stock.

All these facts must be borne in mind in drawing conclusions from laboratory experiments.

PLAGUE AND FOOD.

Our experiments show that food products may harbor the infective principle of plague, but according to experience food products are not much to be feared as far as their probability of carrying the infection is concerned. This latter statement does not apply to milk and its products, for milk is a good culture medium for the bacillus pestis; and we kept it alive seventeen days in cheese and seventy-two days in butter.

On the surface of food products it usually died very quickly. It did not live twenty-four hours on orange peel. We had similar results with figs and raisins and a large quantity of Chinese food products, such as smoked and dried ducks, dried oysters, dried cuttle fish, dried ducks gizzards, ducks gizzards dried and packed in oil, smoked and dried pork, and duck eggs preserved in a mixture of mud and rice chaff, all of which were infected with the bacillus pestis and kept at 37° C.

In rice we found it alive eighteen days after inoculating.

These results correspond with all our other experiments, which plainly prove that the bacillus can not live long on the surface of objects, when dry, at temperatures above 30° C. These results are also in accordance with the clinical and pathological facts, for cases of plague that have their origin in the alimentary tract are comparatively rare, and the spread of the disease has not, as far as I am aware, ever been clearly attributed to food products.

However, tonsillar and intestinal forms of the disease have been recorded, and these cases may be due to the fact that the bacillus can live in milk, butter, and cheese, rice and similar moist, albuminous media, as well as in water (*vide infra*) a long time.

PLAGUE AND WATER.

Plague is certainly not a water-borne disease, although we find that the plague bacillus can live a long time when abundantly inoculated

into water containing a trace of organic matter. In one case we kept it alive one hundred and sixteen days, and in another ninety-six days, in water preserved at low temperatures, 17° to 19° C. Under the same conditions the organism lived only six days at 37° C.

In these experiments the water was sterile and abundantly inoculated with a vigorous culture and carefully preserved from contamination in the dark. In nature the water certainly would not be sterile; the effect of sunlight and dilution would play an active part to diminish its vitality and infective power.

THE EFFECT OF TEMPERATURE.

The effect of temperature upon the bacillus pestis is very remarkable. That it is very sensitive to slight changes is well shown in Table A. In fact, temperature seems to be the most important factor in the viability of the organism. It may be kept alive and virulent a very long time in the cold, even though dry, but it can not live long when dry at the temperature of the body. High temperatures, such as 70° C. or more, are invariably fatal in a few minutes. All the published experiments agree upon the influence of temperature upon this microbe. It was this that led some of the early workers to conclude that they were dealing with a frail organism. It is frail when dried at 37° C., but may live for months in the cold. We have never been able to keep it alive more than a few days when dry at 37° C.—three days in flannel, two days in sponge. On the contrary we had little difficulty in keeping it alive on a variety of objects three and four months at 17° to 19° C.

The bacillus is not as sensitive to temperature when kept moist, for under such conditions it will live a very long time in albuminous media at 87° C.

PLAGUE AND COLD WEATHER.

From the experimental studies with the plague bacillus we would infer that the endemic foci of plague should be in cold climates. The organism dies so rapidly when dried at temperatures above 30° C. that we would not expect the disease to be very tenacious in the tropics. This supposition is only partially borne out by the facts. A certain number of the endemic foci of plague are in a very rigorous climate. Such in particular are the regions of the Garwhal and of Kumaon[1] where the disease came from the snow-capped Himalayas. In the Transbalkan districts the average temperature in winter is 20° C. In Mongolia the climatic conditions are similar. At Vetlianka during the epidemic of plague in 1878-79 the temperature was 12° C.

[1] "Netter, La Peste et son Microbe."

PLAGUE IN THE TROPICS.

Netter states in his "La Peste et son Microbe" that the disease has never invaded the regions where the temperature is tropical, and he notes its disappearance in Egypt with the summer. This statement would be a confirmation of the fact that the organism does not as a rule live outside of the body very long at temperatures of 37° C. and over. But there are other ways of spreading the disease that must be taken into account, such as the direct contagiousness of the pneumonic form of the disease through the coughing, etc., of the plague-laden sputum; also by the means of fleas and rats. This may account for the existence and spread of the disease in such hot countries as the Bombay Presidency, Manila, the Island of Mauritius, Rio de Janeiro, and Santos, all of which are in the tropics and suffer with tropical heat.

THE EFFECT OF MOISTURE.

Moisture is a definite factor in the viability of the bacillus pestis. The organism must have moisture to grow, and it may remain alive and virulent a very long time in the presence of moisture.

It usually dies quickly when dry. However, this is not invariably the case. We have been able to keep it alive in media such as dried albumin for one hundred and twenty-five days, when it was still virulent for mice. But to be kept alive when dry the organism must be cold, i. e., exposed to a temperature less than 20° C.

In no instance could the organism be kept alive when dry at a temperature of 37° C. for more than a few days.

EFFECT OF SUNLIGHT.

Our experiments confirm those of other workers in this field, who find that for the most part the bacillus pestis soon dies when exposed to bright sunlight. Our work leads us to the conclusion that the heat as well as the sunlight plays an important rôle; also that the effects of the sunlight do not penetrate very deeply. It is therefore safe to say that objects may be efficiently disinfected on the surface by exposing them all day to a bright sun, provided the temperature in the sun is above 30° C.

PLAGUE IN THE SOIL.

The plague bacillus was kept alive a long time in moist garden earth, especially when kept cool. It dies very quickly in dry earth. We were not able to keep it alive longer than twenty-four hours at any temperature in dry earth.

As moist earth will preserve the life of the bacillus it is easy to understand how the infection may live in dirty dwellings. It requires no stretch of the imagination to understand how the infection may be spread by the dirt and dust of moist, sunless habitations.

PLAGUE ON NEW MERCHANDISE.

We have not succeeded in keeping plague alive very long when dried upon the surface of objects; even on plush, carpet, paper, wood, sawdust, bone, etc., it usually dies within a few days. In porous substances, such as sponge, we found it alive after one hundred and twenty-five days, when allowed to dry at 19° C. Here again temperature plays an important role, for at 37° C., all the other conditions being the same, it lived only two days.

It is therefore very unlikely that new merchandise would be so contaminated as to carry the infection of the disease, especially in hot weather.

PLAGUE IN CLOTHING AND BEDDING.

The bacillus of plague lives long in albuminous matter. Clothing and bedding are especially apt to be contaminated with the discharges from buboes and blisters, sputum, etc. Articles so infected and kept in a cool, moist place could retain the active infective principle a very long time. Our work shows plainly that clothing and bedding may harbor the bacillus of plague for months. In one instance we kept it alive on a piece of crash ninety-seven days; in albumin gelatin balls one hundred and twenty-five days; in sponge, also, one hundred and twenty-five days; in wool fifty-two days.

PLAGUE IN THE MAIL.

According to our results the plague bacillus can not live long in letter mail. In seven tests made with cultures of the organism on paper we found that it usually died within twenty-four hours. At most it kept alive eight days on paper allowed to dry, and fourteen days on paper kept in a moist atmosphere. To live this long it must be kept cool, for, just as in all our other experiments, it died very quickly when dried at the body temperature. We had similar experiences with plague blood upon paper. Letter mail is therefore not apt to carry the infection of plague a long time, especially in warm weather.

VIABILITY AND VIRULENCE.

The bacillus pestis often loses its virulence before it dies. In many of our experiments we found that the time came when the organism grew in bouillon, but lost its pathogenity for animals. This is an important fact from an epidemiologic standpoint, for an attenuated plague bacillus is probably harmless to man, even though its virulence can be increased by artificial means in the laboratory.

GASEOUS DISINFECTANTS FOR THE PLAGUE BACILLUS.

The experiments conducted in this laboratory plainly prove that either sulphur dioxide, when moist, or formaldehyde will kill the bacil-

lus pestis when applied in the strength and by the methods usually employed for these gases as disinfecting agents. In order to be effective there must be direct contact between the gas and the germ. In other words, these gaseous disinfectants can only be depended upon as surface disinfectants.

In Laboratory Bulletin No. 3, on "Sulphur Dioxide as a Germicidal Agent," Geddings found that 4.25 per cent. of that gas for twenty-four hours time invariably kills the bacillus pestis on the surface.

My own work with formaldehyde (soon to be published) shows that the plague organism is as susceptible to this germicidal agents as other non-sporebearing organisms. Any of the standard methods for evolving the free formaldehyde gas are applicable.

As far as practical disinfection for plague is concerned, it may be mentioned here that sulphur dioxide is probably a much more useful agent for use in ships, stores, houses, and dwellings infested with vermin, because it is destructive to the higher forms of animal life, whereas formaldehyde fails to kill mammals and insects with the same certainty that it kills microbes. In combating plague it is very important to kill the fleas, rats, mice, and other forms of animal life capable of carrying the infection. Sulphur has this power, which formaldehyde totally lacks.

CHEMICAL DISINFECTANTS FOR THE PLAGUE BACILLUS.

The bacillus of plague shows no special peculiarity in its relation to chemical disinfectants in solution. We have found the ordinary disinfectants to have very marked aseptic powers.

Solutions which prevent the growth of the bacillus pestis:

Bichloride of mercury and hydrochloric acid	1 to 50,000
Bichloride of mercury	1 to 25,000
Formalin	1 to 25,000
Carbolic acid (pure)	1 to 830

The following table gives the results of the German plague commission upon the power of disinfecting agents in relation to the bacillus pestis:

AGENT.	Number of minutes necessary.
Carbolic acid :	
5 per cent	1
1 per cent	10
Lysol :	
2.5 per cent	1
1 per cent	5
Sublimate, 1 to 1,000	Immediate destruction.
Chloride of lime, 1 to, 1000	15
Quicklime	30
Milk of lime mixed with equal quantity of salt	60
Black soap :	
1 per cent	More than an hour.
3 per cent	30 minutes.
Sulphuric acid, 1 to 2,000	5
Hydrochloric acid, 1 to 1,000	30

THERMAL DEATH POINT.

We had abundant opportunity in our work in making Haffkine prophylactic to demonstrate that a temperature of 70° is invariably fatal in a short time.

The following table shows the maximum number of days we have kept the organism alive on the objects used in these experiments, and the temperatures under which the experiments were conducted. The table shows at a glance how frail an organism the bacillus pestis is at the body temperature. At 22° to 29° C. it shows much more resistance. At 17° to 19° C. it lives a very long time, even when dry.

TABLE A.

MAXIMUM NUMBER OF DAYS THE PLAGUE BACILLUS LIVED ON THE VARIOUS OBJECTS AT DIFFERENT TEMPERATURES.

TEMPERATURE.	37° C.	22° to 29° C.	17° to 19° C.
	Days.	*Days.*	*Days.*
Gelatin culture in albumin-gelatin balls	.....	75	112
Agar suspension in—			
Tap water	6	71	116
Water	6	71	96
Bouillon culture on—			
Paper, dry	0	3	8
Paper, moist	.....	8	14
Wood	0	0	0
Sawdust	0	0	2
Wool	.....	.....	52
Flannel	3	3	3
Sponge, dry	2	97	125
Garden earth, dry	1	1	1
Garden earth, moist	14	84	93
Bone	1	6	17

TABLE A.—*Concluded.*

TEMPERATURE.	37° C.	22° to 29° C.	17° to 19° C.
	Days.	*Days.*	*Days.*
Agar suspension on bone dust—			
Dry	1	4	6
Moist	125	108	125
Bouillon culture on crash	0	8	97
Cultures on carpet and plush	0	0	0
Milk inoculated with plague	49	68	32
Bouillon culture in—			
Cheese	17	17	13
Butter	5	55	72
Cultures on figs and raisins	0	0	0
Bouillon culture on—			
Salt beef	.....	3	.....
Orange peel	.....	0	.....
Rice	0	3	18
Large variety of Chinese food products	.....	.....	3
Spleen of plague rabbit	45	1	65
Plague blood on—			
Filter paper	0	4	6
Crash	0	4	1
Sponge	0	.....	9
Wood	0	.....	6

CONCLUSIONS.

(1) The bacillus pestis is not a frail organism. It resembles the hemorrhagic septicæmic group or the cocco-bacilli as far as its viability is concerned.

(2) Temperature is the most important factor in the viability of the plague bacillus. It keeps alive in the cold, under 19° C., a very long time. It dies quickly, especially when dried, at the body temperature, 37° C.

(3) Moisture favors the life of the bacillus pestis. It usually dies in a few days when dry, even in the presence of albuminous matter, provided the temperature is above 30° C. It may keep alive and virulent when dry for months in the cold, under 19° C.

(4) Sunlight kills the organism within a few hours, provided the sun shines directly upon the organism and the temperature in the sun is over 30° C. The effect of sunlight is not very penetrating.

(5) The virulence of the bacillus pestis is often lost before its vegetability.

(6) It is unlikely that new dry merchandise would carry the infection. The organism usually dies in a few days on the surface of objects such as wood, sawdust, bone, paper, etc.

(7) Clothing and bedding can harbor the infection for a long time and may act as fomites. The bacillus lives for months when dry in albuminous media at temperatures under 20° C.

(8) Food products may carry the infection of plague. The bacillus lives a long time in milk, cheese and butter. It usually dies quickly on the surface of fruits and prepared foods.

(9) The organism may live a long time in water, although plague is not a water-borne disease.

(10) The plague bacillus does not live long on paper, and first-class mail is therefore not apt to convey the infection.

(11) The colder the climate the greater the danger of conveying the infection on fomites—clothing, bedding, food, merchandise, etc.—and more extensive disinfection is required in such a climate in combating the disease than in tropical regions.

(12) The plague bacillus is destroyed by sulphur fumigation and by formaldehyde gas in the strengths in which these disinfectants are usually employed. The gases can only be depended upon as surface disinfectants. In disinfecting ships, warehouses, dwellings and other places infested with rats, fleas and vermin, sulphur is better than formaldehyde, because formaldehyde gas fails to kill the higher forms of animal life.

(13) A temperature of 70° C. continued a short time is invariably fatal for the plague bacillus. The ordinary antiseptics are all efficacious in their usual strength for non-spore bearing organisms. Efficient surface disinfection may be accomplished by exposing objects all day to the direct sunshine on warm days. The temperature in the sun must be above 30° C.

CULTIVATION OF THE BACILLUS INFLUENZA.

By ADOLPH GEHRMANN, M. D., Chicago.

During the influenza epidemic in Chicago during 1898, special attention was given to verifying the diagnosis of this disease by bacterial examinations. The results of the finding of influenza bacilli in throat cultures were reported by Dr. F. E. Wynekoop, assistant bacteriologist, in the department bulletin of January, 1899, "Concerning the Bacteriology of Influenza."

The general outcome of this study was to prove conclusively that the Cannon bacillus was a recognizable organism under the same conditions as those employed in the routine examination of throat specimens. Since that time our attention has been continuously directed towards finding influenza bacilli in these examinations, and we now feel as confident in the recognition of this organism as in the recognition of diphtheria bacilli. The bacillus has been isolated many times during and since this period, which has given opportunity for a closer study of the characteristic growths.

ISOLATION OF THE BACILLUS.

The observations of Wynekoop show that this bacillus can be cultivated from the throat in the same manner as the diphtheria bacillus when blood serum containing hæmoglobin is used. Such serum gives prompt and entirely characteristic growths. It should be quite brown in color. For the purpose of rapid isolation in suspected cases, it is our practice to proceed as follows: a loop of bouillon is gently rubbed over the surface of the inoculation from the throat when received at the laboratory. Transfers of this are made to the surface of other serum and widely distributed over the several cultures. These transplantations are then incubated along with the orginal and, in positive cases, one will have typical isolated colonies at the time the original culture is ready for examination. This method is followed in those cases where the clinical or probable diagnosis of influenza is recorded on the blank accompanying the specimen.

CULTURE MEDIUM.

Special media proposed for this organism have no advantages over the dark colored blood serum. This was found true of agar prepared with yolk of egg and blood agar. Agar slants, however, with either human or cattle blood spread over the surface were found of service

when the supply of serum was insufficient. Ordinary media are worthless for the precise study of this organism.

CHARACTERS OF GROWTH.

It is generally said that the colonies do not become confluent. Kitasato is quoted as considering this as typical. We have often seen the small colonies of a culture become confluent and a true mass growth result as the culture became older. Further mass growths have been intentionally prepared. Such mass growths are peculiar in that the central point is nearly, and at times quite, invisible. At the edge a fine rounded line of growth is visible, which, in older cultures, after sixty to seventy hours, becomes finely dentate. The entire surface is moist and shiny in the very earlv stages. It may be slightly granular for a time. On transparent media only a faint film is visible.

THE COLONIES.

On blood serum these are characteristic. Beside the usual description of dew drop we have noted, in older and widely separated colonies, the formation of a fine line of elevation just within the margin, a flatting out of the central portion and a fine marked dentate margin. The dew drop appearance is gradually lost after twenty-four hours. We have had cultures in which individual and separable colonies reached a diameter of 3-4 m. m. Another peculiarity noted has been the removal of color from the serum about each colony so that they appeared in the center of a pale area. On very dark or on lightly colored serum this feature is not apparent.

LENGTH OF TIME CULTURE CAN BE MAINTAINED.

By frequent daily or on alternating days transplantation, the influenza bacillus can be maintained as a characteristic culture for a long time, often for several months. It does not remain alive many days on the same culture. Approximately seven days for most of the cultures made was found to be the limit of time at which active transfers could be made. The bacteria remained alive longest in isolated colonies. Their virulence was not tested.

CULTIVATION UNDER SPECIAL CONDITIONS.

In view of certain facts noted by Dr. F. W. Reilly in regard to a relationship between influenza deaths and meteorological conditions in Chicago, the following experiments were made to show the effect of sunlight upon growths of this organism.

Cultures of diphtheria were used as control growths. A number of forty-eight-hour growths on blood serum were exposed on a window

ledge in direct sunlight for periods from one to four hours. Transplantations were made at one, two, three and four hours to fresh media. The results showed that the bacteria were not killed. Diphtheria cultures exposed at the same time were not killed. This experiment was repeated several times with a similar outcome. The time was extended to six and one-half hours upon several occasions.

Next, suspensions of these bacteria were spread upon microscope slides and allowed to dry in the dark where they remained. Inoculations to serum were made from these slides at intervals and the results noted.

	Influenza	Diphtheria
4 hours	+	+
7 "	few colonies	+
12 "	very few colonies	+
23 "	—	+
47 "		few colonies.

A similar series of preparations was made and exposed to bright sunlight with the result that both influenza and diphtheria were shown to be dead in six hours. These last experiments were repeated several times with similar results for influenza, but diphtheria showed on one occasion a few colonies after seven hours exposure.

It appears from these experiments that B. influenza can be grown or exposed to sunlight without being injured in activity. It is, however, well known that this bacillus is very sensitive to drying and that they only resist the dry state in the dark a short time, drying together with exposure to strong sunlight leads to rapid death of the bacteria.

The effect upon virulence was not studied.

Laboratory of the Department of Health, Chicago, Illinois.

THE BACTERIAL CONTAMINATION OF CITY MILK—IS IT HARMFUL? SHOULD IT BE CONTROLLED BY HEALTH AUTHORITIES?

By WILLIAM HALLOCK PARK, M. D., Director Research Laboratory, Department of Health, New York City.

For some time we have been interested in New York in deciding whether it were best to make some bacteriological standard for milk supplies. The reason was the discovery of the enormous development of bacteria in the city's milk. For instance, this summer the milk in New York contained from one million to one hundred million bacteria per c. c. as it came in on the trains. There are only two children's institutions in New York where the milk contained on the average under one million per c. c. during the hot weather. The bacteria in the milk from the others ran all the way from 1,000,000 to 100,000,000 per c. c.

It seemed fair to me to assume that such large numbers of bacteria were harmful. This opinion was not then founded on any experiments of my own, but on the very general opinion of children's physicians. I think we all agree that such a number of bacteria in milk is utterly unnecessary even in the hottest weather. During the last six months, through the Health Department, and through the help of the Rockefeller Institute for Medical Research, we have been carrying on work along three lines: 1st, examining milk on the cars, when delivered in the city and when sold at the stores; 2d, studying conditions at the farm, to learn why such a development of bacteria should take place and how it could be prevented; and 3d, studying the health of children and infants receiving milk of different grades of purity. The full report of the observations of the physicians on these babies will be published after a second summer's observations in a communication to the Rockefeller Institute.

In the first place then as to the number of bacteria in the city milk: From an examination of nearly 1,000 specimens, gathered by Dr. Herman Betz and his Health Department Inspectors, from the cars, the wagons, and the stores, and many specimens taken from the children's asylums, there is no question about the enormous number of bacteria present in the city milk.

Now, as to the harmfulness of this milk: The group of children under one year on heated milk received from decent farms, running before heating from one to five million bacteria per c. c., did not so far as we could see suffer any serious harm from the bacterial products

in the milk. During the summer these children had off and on intestinal disorders, but not much more than those in the same section of the city receiving milk from the very best possible dairies around New York. The children on Pasteurized milk showed some very interesting results. There were very few bacteria in this milk when first received, anywhere from 10,000 to 20,000; but on the second day they had so increased as to be from ten to thirty millions. In some cases where the second day milk was given, there was immediate vomiting followed by diarrhœa. As the freshly Pasteurized milk did not produce this poisoning, there seems to be no question but that the bacterial changes in the milk rendered it unwholesome.

The fresh milk running rather high in bacteria which did so little harm was sterilized, according to the practice of the people of the tenement houses. The heat not only killed the bacteria but probably diminished the deleterious products of their growth.

The group, getting cheap four-cent milk from the groceries, did badly. The bacteria did not run very much higher in this milk than in that first mentioned—probably about four times as high, on an average—and it is impossible to say why the results should have been so much worse unless not only the number but also the varieties of bacteria were different, or that in addition the milk was produced by cows in poor health. Among the infants fed on four-cent milk from the grocery stores, four of the twenty-five children died, while there were only two deaths among all the other groups comprising nearly one hundred children. In all cases where they developed intestinal disturbances the infants were taken for the time off the modified milk and everything done to aid the children to regain their health. If they improved they were put back on their old milk. Of course, we did not give the children bad milk; we simply watched a certain number on the milk they were taking, while to others we supplied pure milk.

In the childrens asylums, where the children were from three to thirteen years of age, we found no trouble during the summer months from the milk, although in some cases it ran as high as 100,000,000 bacteria per c. c. As controls we watched infants in the hospitals and in the tenements taking breast milk, and these not infrequently developed intestinal disorders, showing that we could not in all infants taking cow's milk attribute these disorders to the milk impurities.

Altogether it seems that fairly numerous bacteria in milk obtained from clean healthy cows living on good farms do not cause harm in the older children, and the products do not cause much harm in younger children when subjected to heat. When milk contaminated badly and is improperly kept, so that the bacteria greatly multiply, is

fed to babies, they do badly, and it seems that much of the mortality is due to poisonous conditions of the milk developed by bacteria.

The reasons for the enormous development of bacteria in the milk were insufficient cleanliness in getting the milk and very faulty cooling arrangements. The farmers mostly put their milk in springs; as the summer advances the water gets higher in temperature until it reaches about 60°. Some farmers hardly cool their milk at all. I have also seen milk shipped in cans standing in a car where the temperature was at 90° and left there without any ice for seven hours. The City Health Board has passed a rule that all milk shall be at 50° or under when it reaches New York City. This rule will be enforced in 1902.

We have found that milk from a decent farm properly cooled will not run over 100,000 bacteria per c. c. at the end of twenty-four hours, and that such milk if kept for two days at 45° F. will not run more than 200,000, therefore, all milk that runs over 1,000,000 bacteria per c. c. has certainly not been kept in a proper condition, and such a number of bacteria indicates faulty methods of caring for the milk. The Health Board has passed a resolution saying that milk containing excessive numbers of bacteria is unwholesome and should not be sent to New York. This summer we have been sending circulars to farmers or dairymen selling milk running over 1,000,000 bacteria per c. c. Next year the Health Department will begin to take away the license of dealers who furnish such milk. The bacterial count will be used not to destroy milk already received, but as an indication where to look for faulty methods of producing and caring for milk.

THE NON-NITRIFICATION OF SEPTIC SEWAGE IN CONTACT FILTERS.

By H. W. CLARK, Chemist Massachusetts State Board of Health.

In the study of the purification of sewage by various kinds of filters at Lawrence during the past two years, it has been noticed that it is exceedingly difficult to purify in contact filters a so-called "septic" sewage in some stages of putrefaction, while the same sewage can be readily purified in intermittent sand filters. In order to explain these results fully, certain studies have been made. It is, of course, evident that we can not obtain nitrification within a filter unless there is an ample supply of air held within the pores of the filter in contact with the sewage, to admit of bacterial oxidation. Frequent examinations, however, of the effluents of the sand filters and coke filters receiving different varieties of septic sewage have shown that the effluents of the contract filters, receiving what we designate at the station as "septic sewage B," have not contained dissolved oxygen, neither has there been the slightest nitrification of this sewage when held for different lengths of time in these contact filters. It was decided after preliminary experiments that the cause of this was probably the rapid absorption of oxygen by the sewage after its introduction into the filter—so rapid that whatever body was oxidized the oxygen present was used too quickly for nitrification to occur.

To show this rapid absorption of oxygen by septic sewage, compared with its slow absorption by fresh sewage, some experiments were made. For this purpose the sewage as it comes to us from the city sewers, septic sewage A—not a very old sewage—and septic sewage B—a concentrated sewage carried to a considerable degree of putrefaction—were employed. The method of making these experiments was as follows: Into half-gallon bottles, one-quarter filled with water saturated with dissolved oxygen, the sewages were siphoned in such a manner as to prevent any contact with oxygen when entering the bottles, except when reaching the water in the bottles, the bottles being quickly and entirely filled with the mixture of the water and sewage. Samples for the determination of the dissolved oxygen were then siphoned from these bottles into small bottles in which the determinations were made; one sample being examined immediately and the rest remaining stoppered for different periods. The per cent. of saturation of dissolved oxygen in the various mixtures should have been about twenty-five in each case at the time of the first analysis, if

no absorption of oxygen had taken place during the time employed by manipulation. The results, however, were as follows: We found that the regular Lawrence sewage, as we have called it, did not exhaust all the oxygen present after the mixture was made in a period less than from three to six hours; septic sewage A would exhaust the oxygen in a period of from one to two hours; while septic sewage B would exhaust the oxygen so quickly that none could be found at the time of the first examination of the mixture, although, as was said, this examination was made as soon as possible.

It was evident from these experiments that allowing septic sewage in this condition to remain in contact filters for nitrification to occur was a useless procedure, as we cannot expect nitrification without the presence of oxygen. When such sewage as that from septic tank B is run in a comparatively small volume upon the surface of intermittent sand filters, however, it remains upon the surface in most instances long enough for considerable oxidation to take place, and it meets in passing through the filter a very large volume of air compared with the volume of sewage being purified. In other words, our experiments have shown that, when a small volume of sewage is applied to a sand filter, nitrification will take place, no matter to what degree of putrefaction this sewage has attained at the time of its application, if there is an abundance of air to come in contact with the sewage. When, however, sewage in an advanced state of putrefaction is applied to a contact filter and the entire open space of the filter filled with this sewage, it is possible that oxidation may be so rapid that the supply of oxygen within the filter will be exhausted before nitrification has had time to begin. This rapid absorption of oxygen, moreover, did not cause a change in the character of the organic matter of the sewage that could be readily detected by ordinary chemical analyses, and for this reason experiments were undertaken to show whether it was a bacterial or a chemical action.

To do this, a sample of septic sewage B was sterilized by heat, this not only killing the bacteria, as determined, but expelling the gases also. The sample then had water saturated with oxygen mixed with it, as previously described, and was then allowed to stand, samples for the determination of dissolved oxygen siphoned from the bottle, and determinations of dissolved oxygen made. At the beginning of the period the mixture contained 65 per cent. of saturation, and at the end of the period 63 per cent., showing that sterilizing the sewage by heat and expelling the gases had so changed it that the quick absorption of oxygen did not occur. A second volume was sterilized with mercuric acetate, this, of course, killing the bacteria, as determined by tests, but not expelling the gases. The sewage was then, as usual, mixed with

water saturated with dissolved oxygen and determinations of this oxygen made immediately after the mixture, and once an hour for practically eight hours. Immediate examination showed that nearly all the oxygen had been rapidly exhausted, although the sewage had been sterilized. These experiments were repeated and seemed to prove conclusively that the rapid absorption of oxygen was by gases or by intermediate decomposition products; that is, it was a chemical absorption rather than an exhaustion by bacterial action.

SOME POINTS IN THE LIFE HISTORY AND IN THE DECOMPOSITION OF BLUE-GREEN ALGÆ AS ILLUSTRATED BY OSCILLARIA PROLIFICA (WITH SAMPLES).

By ELLEN H. RICHARDS.

The disfavor with which the presence of a certain plant or animal in a water supply is regarded depends upon one of two things, it offends the æsthetic sense, eye or taste, or it is itself a menace to health or at least indicates the presence of substances which may be dangerous.

For many years the plant growths in certain lakes and reservoirs have been a source of annoyance to superintendents and of uneasiness to consumers. To my knowledge, no case of disease has been directly traced to any of these plants. In 1897 Jackson and Ellms in their paper on Anabæna said "the sanitary significance of these partially decomposed compounds in drinking water is yet to be determined, but analysis would indicate that their effect upon the general health would be unfavorable were it not for the fact that they occur in such minute quantities," Tech. Quart., Vol. X.

The frequency with which members of the Cyanophycæ are met with in water supplies, especially in stored water, warrants time and thought from sanitary experts and the gathering of data from every source.

So far as examined all the members of the group are highly nitrogenous, containing from 9 to 11 per cent. of nitrogen, thus nearly approaching animal substance. They also contain sulphur and phosphorus, again approaching the animal. These elements must be supplied in order that the plants may find them, and a warning should be given to those engineers who think it sufficient to take out of polluted water the organic material leaving abundant nitrogen in the form of nitrates and plenty of compounds of sulphur and phosphorous to furnish food for plant growth. As the necessity of reusing water once polluted increases, so will increase the importance of a knowledge of the life history of those blue-green algæ which are liable to become the greatest pests in reservoirs of filtered water.

One body of water so infested has been under close observation for fourteen years and although the particular plant is not a common one it should serve at least to point the moral, it certainly will adorn the tale because of its brilliant colors.

The name by which it is known—according to Farlow—is oscillaria prolifica, Greville.

Without going into either botanical or chemical details, both of which will be given elsewhere, a few words on the conditions of assimilation of its food will not be out of place here.

First as to temperature. The first noticeable development takes place in the spring when the temperature of the water reaches 60° to 64° F. for a depth of at least two feet. The plant grows rapidly at 65° to 68° the sudden "blossoming" takes place at about 70° when as sudden decay occurs. This is in marked contrast with anabæna which thrives best from 70° to 75° F. This season has been a peculiar one and twice after a cool, cloudy week with rain—meaning food, both ammonia and CO_2—a decided growth has occurred. Second, as to food; the water furnishes plenty of it, nitrates and all the mineral elements. On decaying these are given back to serve other purposes of plant and animal life and another season to reappear in the form of this beautiful plant.

HYDROCYANIC-ACID GAS IN PUBLIC HEALTH WORK.

By JOHN S. FULTON, M. D., and WILLIAM R. STOKES, M. D.,
Baltimore, Maryland.

In American Medicine, May 11, 1901, one of us published a preliminary note on hydrocyanic acid as a gaseous germicide. Experiments made by exposing various bacteria, in media, on glass rods, on cotton swabs, and on bits of linen in closed glass jars to the action of high percentages of the gas showed that the gas is highly destructive of non-sporulating bacteria.

Four experiments were reported in which the bactericidal power of the gas was tested in a room of 1400 cubic feet capacity, having three sides of tongued and grooved plank, one end of rough stone, one small hinged window, and a loose door. In the first of these experiments the amount of gas used was that liberated from 600 grammes of potassium cyanide, in the second experiment 1,500, in the third 1,200, and in the fourth 1,500 grammes of cyanide were used. The period of exposure was in all instances twenty-four hours.

These experiments seemed to show that with twenty-four hours exposure and an amount of gas equivalent to one gramme of cyanide per cubic foot of space, hydrocyanic-acid gas gave as good a surface disinfection as is in practice obtained with formaldehyde. The organisms used were B. diphtheriæ, B. coli, B. typhosus, B. subtilis, staphylococcus pyogenes aureous, and staphylococcus albus. Since the cost of room disinfection with hydrocyanic is about four times that of formaldehyde disinfection, since the gas is more dangerous than formaldehyde, and since the only advantage in the use of hydrocyanic acid is lessened risk of fire, we regard these observations on the bactericidal power of hydrocyanic acid as interesting rather than valuable.

Its well known destructiveness of animal life seemed to indicate that hydrocyanic acid might be useful in the prophylaxis of those diseases which are known to be conveyed by insects and rodents.

In the treatment of the parasitic disease of plants and in the disinfection of nursery stock hydrocyanic acid has been successfully employed since 1897. During this time the dangerous chemicals have been freely handled by inexpert persons, and careful observations upon various important points concerning the manufacture and use of the gas have not been made.

The chemicals employed are cyanide of potassium, concentrated sulphuric acid and water, in the relative proportions of 1, 1.5, and 2.25.

The amount of gas to be used is expressed in terms of cyanide—25 grammes of cyanide per 100 cubic feet of enclosed space.

The manner of procedure in plant fumigation is, first of all, to enclose the space to be fumigated. In the orchard, trees are surrounded by a canvas tent. Nursery stock, prepared for shipment, is fumigated in a closed room.

An earthen vessel is placed within the enclosure, and then the dilute acid is prepared. The requisite quantity of water having been first put into the vessel, the acid is poured in slowly, stirring with a stick. After this the whole amount of cyanide is dropped at once into the dilute acid. The evolution of gas by this method is exceedingly rapid, and unless the capacity of the vessel is two or three times greater than the volume of the chemicals, part of the material may be thrown out by the effervescence.

This method does not seem well suited to the fumigation of ships or houses, and our experiments were conducted upon a different plan. We connected three jars, placed at suitable relative elevations, by siphon tubes. The requisite amount of cyanide was placed in the lowest and largest jar. The intermediate jar contained the water, and the upper jar the concentrated acid. The lower of the two siphons was automatic, and was actuated by a definite height of liquid in the intermediate jar. It did not therefore operate until the last few ounces of acid were being delivered from the upper jar into the intermediate one. By this method the operator has time to leave the room and to close up behind him, and there is no danger that the destructive chemicals will escape from their containers.

It is not necessary, of course, to dilute the acid just when it is to be used, but it is usually preferable to do so, since water can be had anywhere, and it is more convenient to carry the concentrated acid.

Cyanide of potassium suitable for this purpose costs at present thirty-two cents a pound, and is 98 per cent. pure. Concentrated sulphuric acid of the proper quality costs in carboys two cents a pound. The cheaper chamber acid used in fertilizer works is unsuitable.

Before commencing to experiment upon insects and animals we had the sides and floor of our room covered with tar paper, and the door and windows weather-stripped. Two shelves were built across the window, and here the cages containing animals and insects were placed for easy observation.

The exact moment when effervescence began was noted in every experiment and accurately-timed observations were recorded.

The insects were exposed in wire traps, or in tubes and flasks more or less protected by cotton stoppers. The amount of defensive covering was always noted.

We shall not reproduce here the experiments in detail, but shall record simply the results. The amount of gas used was equivalent to 25 grammes of cyanide to 100 cubic feet of space in all instances, except the experiments upon food materials, in which 100 grammes of cyanide were used for each 100 cubic feet of space.

House Flies (*Musca domestica*).

We made no attempt to protect house flies, but exposed them in the ordinary wire traps. They were killed in from two to four minutes after effervescence began in the cyanide jar.

Wood-Eating Termites (*Termes flavipes*).

White termites were exposed in bottles with perforated metal caps, in a test tube with loose cotton plug, and in a quantity of infested wood in a large uncovered Petri dish for a period of ten minutes to an amount of gas equivalent to 25 grammes of cyanide per 100 cubic feet of space. At the end of that time a single living termite was found among the twenty in the bottles. Those in the test tube were killed. The infested wood was broken up and carefully searched for living insects, but only dead ones were found. Two white rats, a gray rat, and two guinea pigs, all in separate cages, exposed at the same time, were all killed.

Roaches (*Periplaneta Americana*).

The common pantry roach exposed to similar amounts of gas died in three to five minutes if free in a wire cage; in eight to ten minutes if confined in a tube with one inch of cotton plug; in nineteen minutes to one hour if protected by two to nine inches of cotton plug. When at liberty in a wire cage roaches showed excitement within ninety seconds of beginning effervescence in the cyanide jar, and if at liberty in the room would have but thirty seconds more in which to find a place of safety.

Bedbugs (*Cimex lectularius*).

Bedbugs were used in but one experiment. Under two inches of cotton the bedbugs showed signs of excitement in five and one-half minutes after the gas began to be liberated, and in fifteen minutes were apparently dead. In plugged tubes inside of a Florence flask plugged with five inches of cotton, *i. e.*, under seven inches of cotton, bedbugs became excited in fourteen minutes, and in twenty-two minutes were apparently dead. The room was closed in this experiment twenty-five minutes, when all were removed at once to open air and examined. Out of sixty or seventy insects, two very young ones were alive.

Mosquitoes (*Culex pungens*).

Only culex was used. In an aquarium jar covered with cheesecloth mosquitoes were all dead within two and one-half minutes after effervescence began. In a Florence flask with the mouth wrapped thickly with cotton, culex was killed in four minutes. In test tubes under two-inch plug, culex was killed in five minutes, and in a similar tube within the wrapped flask, died in seven minutes.

Ox Louse (*Hematopinus eurysternus*).

A quantity of the common cattle ticks of this latitude, exposed in a Florence flask plugged with five inches of cotton, were still alive after twenty minutes, but all seemed to be dead in an hour. The room was not opened for twenty-four hours, when they were, of course, all dead.

Black Ant (*Monomorium minutum*).

Small black ants in test tubes plugged with one inch of cotton were killed in five minutes.

Rats, Mice and Guinea Pigs.

When the gas was made by dropping all the cyanide at once into the dilute acid, rats exposed in cages were overcome in about sixty seconds. When the gas was generated by the siphon method, rats in cages fell in convulsions in from two to three and one-half minutes from the beginning of the chemical reaction, and ceased to move in thirty to forty seconds after falling.

A number of rats were exposed in cages, placed in the doorway, when the room was opened after each experiment. Such rats were overcome in from one or two seconds to one minute, and within a minute and one-half were apparently dead. If the cages were removed to fresh air within three minutes it would often be found that the rats were still breathing, would improve more or less rapidly, and might in five minutes to an hour be quite well again. After three minutes of such exposure a rat, if still breathing when removed to fresh air, had about an even chance for his life. A large male brown rat, overcome after thirty seconds exposure in the open doorway and removed to fresh air after ninety seconds, recovered fully in five minutes. He was then again exposed by being placed a foot or two inside the room. He showed no excitement for several minutes, but after ten minutes he was overcome. On being removed to the fresh air he became himself again within ten minutes. This animal survived four exposures to the gas, and perished in his fifth exposure, which lasted but ninety seconds.

The experiments indicate that when the gas is generated as rapidly in relation to the enclosed space as in a room of 1,400 cubic feet, the

acid being delivered through a siphon of one-quarter inch bore, a rat must make good his escape within three minutes or else perish. In an atmosphere containing the gas from one gramme of cyanide to three cubic feet of space a rat will surely be disabled in thirty seconds, and will die within five minutes.

Mice and guinea pigs succumb more easily than rats. No animal under observation made an outcry. Mice and rats ran about excitedly for a few seconds, became ataxic, and then fell in general convulsions. Sometimes rats showed respiratory irritation by pawing at their nostrils. Guinea pigs showed no signs of excitement. Lying quietly on their abdomens, they were seized in about thirty seconds with a strong opisthotonic spasm, and fell dead without an attempt to change their posture.

Chemical Tests of Diffusibility.

Guaiacum paper dipped in a 2 per cent. solution of cupric sulphate gives a striking color reaction in the presence of very small amounts of hydrocyanic-acid vapor, showing an intense blue color.

Pieces of this moist test-paper placed in tubes and flasks, stopped with tight cotton plugs from two to seven inches long, were exposed during our experiments. These were enclosed in the same way as the insects. A two-inch test tube containing test paper under a one-inch plug was enclosed in a four-inch test tube with a two-inch plug, this again in an eight-inch tube with a four-inch cotton plug, making in all seven inches of cotton to be traversed by diffusion of the gas in still air. In a similar manner the test-paper was enclosed in the inmost of three glass vessels, the outermost being a Florence flask with a five-inch plug of cotton, so that nine inches of cotton plug were to be passed.

The color reaction became very distinct within two containers, under five inches of cotton, five minutes after the gas began to be liberated. The gas reached the inner tube, protected by seven inches of cotton plug, and showed strong color reaction in nine minutes. The color reaction in the inmost of three glass containers, under nine inches of cotton, appeared in twenty-nine minutes.

We tested the diffusibility of the gas by connecting the interior of the room with glass vessels outside the room by means of one-quarter-inch rubber hose, communicating through the keyhole with a glass tube and paraffin plug. In this way pieces of test paper were placed at three, six, nine, twelve and twenty-four feet of distance from the room. The color reaction became apparent at twelve feet distance from the room in fifteen minutes, but the gas was not present in sufficient amount to kill ants or roaches confined in the same vessels even at three feet from the door. In two such experiments we were unable to await results

longer than half an hour, in which time neither insects nor rats were visibly affected.

When, however, a rubber bulb was applied to the outermost glass vessel, and 100 c. c. aspirated, both insects and animals were killed very speedily.

Effects Upon Foodstuffs.

In two experiments we exposed bread, butter and milk for twenty-four hours to the action of hydrocyanic vapor in amounts three times greater than are recommended for the destruction of animals. These materials were then fed to rats, were eaten freely, and no poisonous effects were observed.

* * *

These experiments seems to show that we have in hydrocyanic acid vapor an exceedingly rapid and powerful agent for the destruction of all animal and insect pests within fairly tight enclosures. Ships, houses and railway coaches admit of successful hydrocyanic-acid fumigation without special attention to openings and with no other preparation of their contents than is required to give the gas free access.

The gas is highly diffusible, having a specific gravity of .935, has no injurious effect upon metals, woodwork, textile fabrics, paint or foodstuffs, and rapidly escapes when doors and windows are opened.

Sewers can be fumigated by isolating sections of convenient size, care being taken that the gas has not access to dwelling houses.

The gas is, of course, extremely dangerous to man, but is by no means unmanageable. After each of our experiments the room was entered instantly for the purpose of removing insects and animals. No other caution was used than to suspend respiration while in the room. A strong atmosphere of hydrocyanic acid has no disagreeable effect upon the eyes or nose.

By making a proper distribution of vessels containing the potassium cyanide, and delivering the dilute acid through rubber hose connected with a single container, it is possible to accomplish a very extensive fumigation without exposing the operator to any danger.

After hydrocyanic-acid fumigation of a ship it may perhaps be important to test the respirable quality of the air in the more remote spaces, and this can always be done by exposing a rat or mouse for fifteen minutes, when, if the animal is not overcome, the air may be considered safely respirable.

The cupric sulphate test-paper would be useful in this connection only to show the absence of the gas. The color reaction occurs in the presence of amounts of hydrocyanic acid so small as to be quite harmless. If the presence of the gas were shown by this means in the better-ventilated parts of a ship or house, it might indicate the need of caution

about entering the more secluded spaces. The odor of the gas, however, is so characteristic that one could not approach a dangerous atmosphere without receiving warning through the sense of smell.

The particularly speedy effect of this gas upon mosquitoes seems to bespeak its usefulness in the prophylaxis of yellow fever, malaria, and filariasis. It is generally held that mosquitoes perish in a short time if deprived of water, and it has therefore been thought that infected mosquitoes are very unlikely to survive a voyage if confined in the hold of a ship. On the other hand, mosquitoes may derive sustenance from plant juices, and it is said that they do by this means survive transportation in fruit steamers.

In ship disinfection against yellow fever, formaldehyde gas has had no vogue. Contrary to the laboratory teaching, which regarded only bactericidal power, sulphur dioxide has been restored to its place as the more satisfactory agent for disinfection against yellow fever. The experiments of Rosenau show that sulphur dioxide is vastly superior to formaldehyde as an insecticide, and that it is fatal to mosquitoes in amounts much smaller than are required to kill non-sporulating bacteria. Sulphur dioxide is not, however, so speedy in its action as hydrocyanic-acid gas, and is, besides, injurious to metals and fabrics.

In the prophylaxis of plague a gaseous poison for rats and mice on ship board is a desideratum. Up to the present time no better agent for this purpose has been suggested than sulphur dioxide. In the English experiments with sulphur dioxide it was noted that the rats collected about the ports and hawse-pipes, and most of the bodies were found in such places, showing that the animals had considerable time in which to seek escape. Our experiments show that a rat must escape, if at all, within two or three minutes of being overtaken by the gas.

In military hygiene the speedy and certain action of hydrocyanic-acid makes it available for the routine disinfection of hospital tents and mess tents. The Munson hospital tent, the best yet devised, has a ventilating opening in the ridge. This opening is covered with coarse netting, which does not serve, as it should, to bar the movements of insects. Camp hospitals often consist of a series of these tents. It is quite practicable, by removing the patients and closing the ventilator, to destroy all the flies and mosquitoes in such a tent without putting the tent out of service for more than an hour, and without danger to the occupants of adjoining tents.

The proper point of attack upon the typhoid-bearing flies in camps is at the latrines. This might be accomplished in some such manner as the fumigation of orchards is done. A light square box, of suitable size, made of wood and canvas, open at one end, is attached by block and fall to a light derrick mounted on a wagon. The box is simply

dropped over the tree. The orchardists proceed in this manner from tree to tree, and are not in the least injured by the large amounts of gas liberated. This canvas tent is a tight enough enclosure in which to destroy scale parasites, more resistant than flies or mosquitoes. If the ground is quite rough it is necessary to throw up enough loose earth to close the openings between the tent and the soil. If each camp latrine were shaded at all times with a canvas canopy capable of being lowered to the ground, routine fumigation would require not more than twenty minutes for each latrine.

We are aware that the suggestion to employ this very deadly gas in public health work is not likely to be received with enthusiasm, for hydrocyanic acid in the popular mind far outranks all other poisons. If, however, one will look up the scanty literature of poisoning by the cyanogen compounds, and will reflect that enormous amounts of cyanide of potassium are used by workers of all grades of intelligence in numerous arts and industries, and that the odor of prussic acid is quite frequently observed in the shops and on the streets, one may be convinced that the deadly cyanide is about as amenable to human purposes as many other substances of less ill repute.

AIR TESTING FOR ENGINEERS.[1]

By ELLEN H. RICHARDS.

The increased amount of carbon dioxide above the normal is usually relied upon as an indication of the extent of vitiation of atmospheric air. Hence sanitary engineers, architects, and building inspectors who have occasion to test the efficiency of ventilating systems for private and public buildings, school houses, and halls, are often required to make numerous approximately quantitative determinations for atmospheric carbon dioxide.

For this purpose the usual laboratory methods for the exact estimation of carbon dioxide in the air are not suited. Where comparative results rather than great accuracy are required, some simpler form of apparatus is desirable.

(1) It should be sufficiently compact and portable to be carried in the hand from place to place, and should contain within itself everything required for the complete determination of the carbon dioxide.

(2) It should be as simple in construction as possible, and its use should not involve delicate measurements; if automatic in its action, so much the better.

(3) The complete apparatus should be sufficient for fifty or more determinations.

(4) It must be capable of giving results of a reasonable degree of accuracy, say within 0.5 part of carbon dioxide in 10,000 parts of air, in the hands of persons having little or no chemical knowledge and minimum skill in manipulation.

The present work has been carried out in order to adapt these methods more particularly to the needs of the engineer; to eliminate if possible some of the objections to the Fitz method; to adapt the Cohen method to the use of liter bottles, which are more readily obtained and materially shorten the time of shaking; and to make the two methods interchangeable for the same solution.

[1] For a free discription of the apparatus see Technology Quarterly, Vol. XIV, No. 2, June, 1901.

AN ENGINEER'S KIT FOR WATER INSPECTION.

By ELLEN H. RICHARDS.

It is often a great saving of time and expense to make a preliminary survey with light marching outfit before going into the field with all the paraphernalia for accurate work. Mistakes may be made and difficulties overlooked but every engineer knows how valuable some of the data acquired by the simplest means may become.

Now that water supplies are so largely the province of the engineer, he should apply some of his own methods to the preliminary problems arising in his work.

This was not possible so long as the training of the engineer left him entirely ignorant of the technique of water analysis, so long as the data of the chemist and biologist were only hieroglyphics and his knowledge of the appearance and bearing of the various substances said to have been found in water supplies was derived only from books.

A new order of things exists and the training of the sanitary engineer used in its widest sense includes a familiarity with chemical, biological and bacteriological methods which although not extensive enough to make him an expert is yet sufficient to aid his judgment very materially.

For the use of such engineers as have had a modicum of sound laboratory training; who know quite as well what they do not know as what they are versed in, this little kit has been fitted up. No attempt has been made to give the amateur basic knowledge—no attempt has been made to supersede the laboratory, only to furnish a means of occasional use in this country and to suggest ways of utilizing journeys into unknown or difficulty accessible regions. The methods have all been worked out with care, but doubtless others will be found to serve. This kit assumes a base of supplies to start from. Solid reagents have not been used as they seem more liable to deteriorate.

CONSTITUTION

OF THE

AMERICAN PUBLIC HEALTH ASSOCIATION.

TITLE.

I. This Association shall be called "THE AMERICAN PUBLIC HEALTH ASSOCIATION."

OBJECTS.

II. The objects of this Association shall be the advancement of sanitary science, and the promotion of organizations and the measures for the practical application of public hygiene.

MEMBERS.

III. The members of this Association shall be known as Active and Associate. The Executive Committee shall determine for which class a candidate shall be proposed. The *Active* members shall constitute the permanent body of the Association, subject to the provisions of the constitution as to continuance in membership. They shall be selected with special reference to their acknowledged interest in, or devotion to, sanitary studies and allied science, and to the practical application of the same. The *Associate* members shall be elected with special reference to their general interest only in sanitary science, and shall have all the privileges and publications of the Association, but shall not be entitled to vote.

Delegates from national, state, provincial, and municipal boards of health, organized sanitary associations, and the army, navy, and marine hospital service, shall be entitled to be enrolled as active members upon presentation of their credentials to the Executive Committee. Members, not delegates from such bodies, shall be elected as follows:

Each candidate for admission shall first be proposed to the Executive Committee, in writing (which may be done at any time), with a statement of the business or profession and special qualifications of the person so proposed. On recommendation of a majority of the committee, and on receiving a vote of two-thirds of the members present at the regular meeting, the candidate shall be declared duly elected a member of the Association. The annual fee of membership in either class shall be five dollars.

OFFICERS.

IV. The officers shall be a President, a First and a Second Vice-President, a Secretary, and a Treasurer, and the officers of the various sections.

All the officers shall be elected by ballot, annually, except the Secretary, who shall be elected for a term of three years.

PRESIDING OFFICER.

V. The President, or in his absence one of the Vice-Presidents, or in their absence a chairman *pro tempore*, shall preside at all meetings of the Association. He shall preserve order, and shall decide all questions of order, subject to appeal to the Association. He shall also appoint all committees authorized by the Association, unless otherwise specially ordered.

SECRETARY.

VI. The Secretary shall have charge of the correspondence and records of the Association; and he shall also perform the duties of Librarian. He, together with the presiding officer, shall certify all acts of the Association. He shall, under the direction of the Executive Committee, give due notice of the time and place of all meetings of the Association, and attend the same. He shall keep fair and accurate records of all the proceedings and orders of the Association; and shall give notice to the several officers, and to the Executive and other committees, of all votes, orders, resolves, and proceedings of the Association, affecting them or appertaining to their respective duties.

TREASURER.

VII. The Treasurer shall collect and take charge of the funds and securities of the Association. Out of these funds he shall pay such sums only as may be ordered by the Association, or by the Executive Committee. He shall keep a true account of his receipts and payments, and at each annual meeting render the same to the Association, when a committee shall be appointed to audit his accounts. If, from the annual report of the Treasurer, there shall appear to be a balance against the treasury, no appropriation of money shall be made for any object but the necessary current expenses of the Association, until such balance shall be paid.

STANDING COMMITTEES.

VIII. There shall be the following standing committees: (1) The Executive Committee, (2) the Advisory Council, (3) the Committee on Publication.

EXECUTIVE COMMITTEE.

IX. The Executive Committee shall consist (1) of the President, First Vice-President, Second Vice-President, Secretary, Treasurer, and Chairman of the various sections; (2) of six active members of whom three shall be elected annually by ballot to serve two years, and who shall be ineligible to reëlection for a second successive term; and (3) of the ex-presidents of the Association.

It shall be the duty of the Executive Committee to consider and recommend plans for promoting the objects of the Association, to authorize the disbursement and expenditure of unappropriated moneys in the treasury for the payment of current expenses; to consider all applications for membership, and at the regular meetings, report the names of such candidates as a majority shall approve; and, generally, to superintend the interests of the Association and execute all such duties as may, from time to time, be committed to them by the Association. At least one month preceding the annual meeting of the Association, the Executive Committee shall cause to be issued to members a notice of such meeting, and they are authorized to publish the same in medical, scientific, and other periodicals, but without expense to the Association; and such notice shall contain the order of business to be followed at said meeting, and, briefly, the subjects to be presented and the special points of discussion.

ADVISORY COUNCIL.

X. The Advisory Council shall consist of one member from each state, territory, and district, the army, navy, and marine hospital service, the Dominion of Canada, and each of the Provinces, who shall be appointed by the President on the last day of each session, and who, besides acting as nominating committee of officers for the ensuing year, to be announced at such time as the Executive Committee may appoint, shall consider such questions and make such recommendations to the Association as shall best secure the objects of the Association. They shall at their first meeting elect from their own number a Secretary, whose record of their proceedings shall be made part of the records of the Association.

COMMITTEE ON PUBLICATION.

XI. The Committee on Publication shall consist of a Chairman, the Secretary of the Association, the Treasurer of the Association, and a member of each section of the Association, with the President of the Association, *ex officio;* who shall contract for, arrange and publish, under authority of the Executive Committee, the proceedings of the Association, including such papers as have been examined and

approved by the Executive Committee, or which have been submitted to them by the latter for their discretionary action.

REPORTS AND PAPERS.

XII. All committees preparing reports to be presented to the Association must submit the same to the Publication Committee not later than thirty days before the succeeding annual meeting of the Association; and all papers other than committee reports shall be in the hands of the Secretary of the Association not less than twenty days before.

MEETINGS.

XIII. The time and place of each annual meeting shall be fixed at the preceding annual meeting, but may be changed by the Executive Committee for reasons that shall be specified in the announcement of the meeting. Special meetings may be called at any time or place, by concurrence of two-thirds of the Executive Committee. There shall be no election of officers, or change of by-laws, or appropriation of money to exceed the amount at that time in the treasury, at such special meeting, except by a vote of a majority of all the members of the Association. Whenever a special meeting is to be held, at least one month's notice shall, if possible, be given by circular to all the members, together with the order of business.

QUORUM.

XIV. At the annual meeting nine members shall constitute a quorum for the election of officers, a change of the constitution, the election of members, and the appropriation of moneys.

ORDER OF BUSINESS.

XV. The order of business at all meetings of the Association shall be fixed by the Executive Commitee, and such order must be completed before any other business is introduced, except such order of business is suspended by a vote of four-fifths present.

ALTERATION OF CONSTITUTION.

XVI. No alteration in the constitution of the Association shall be made except at an annual meeting, or unless such alteration shall have been proposed at a previous meeting, and entered on the minutes with the name of the member proposing the same, and shall be adopted by a vote of two-thirds of the members present.

SECTIONS.

XVII. Members of the Association may be authorized to form themselves into sections by vote of the Association at any annual meeting; such sections shall have power to nominate their officers to be elected by the Association, and to make by-laws which shall go into effect when approved by the Association.

BY-LAWS OF THE EXECUTIVE COMMITTEE.

QUORUM.

1. Five members shall constitute a quorum for the transaction of such business as may come before the committee.

MEMBERS RESTRICTED.

2. No elective member of the Executive Committee shall be at the same time a member of the Advisory Council, if there is another member of the Association from his state or service.

PARLIAMENTARY USAGE.

3. Cushing's Law and Practice of Legislative Assemblies shall be the guide of parliamentary practice until otherwise ordered.

PAPERS.

4. Papers to be presented at a general session of the Association shall be in the hands of the Secretary of the Association not less than twenty days before the coming meeting, and to be printed in the transactions in full or in abstract at the discretion of the Publication Committee.

5. All papers accepted by the Association, whether read in full, by abstract, by title, or filed, shall be delivered to the Secretary as soon as thus disposed of, as the exclusive property of the Association. Any paper presented to this Association and accepted by it shall be refused publication in the transactions of the Association, if it be published, in whole or in part, by permission or assent of its author, in any manner prior to the publication of the volume of transactions, unless written consent is obtained from the Publication Committee.

6. Day papers shall be limited to twenty minutes, and evening papers to thirty minutes each.

DISCUSSION OF PAPERS.

7. After the leading papers on each subject, as indicated by the Executive Committee, have been read, discussion shall follow, and be confined strictly to the subject of these papers; and each speaker shall be limited to ten minutes, and shall not speak a second time until after every other member who desires to be heard, and then only for five minutes, except by unanimous consent.

8. The Chair shall notify gentlemen who desire to speak to send up their names, and they shall be called on in the order sent up;

and he may, at his discretion, limit the time of speaking to five instead of ten minutes, if in his judgment it may become necessary to do so in order to allow each one on the list an opportunity to be heard.

PUBLICATION COMMITTEE.

9. The Publication Committee shall consist of a Chairman, the Secretary of the Association, the Treasurer of the Association, and a member of each section of the Association, with the President of the Association *ex officio*.

10. Unless otherwise ordered by the Association, such committee is hereby instructed to keep the size of the annual transactions within the limits of four hundred pages; and to this end to conform to the several following rules:

a. Make summaries of such local and other addresses as are not of permanent scientific value.

b. The Chairman of the several Standing Committees shall be notified by the Secretary that the reports to be presented by them shall include any material prepared by the several members of their committees and must be in the hands of the Publication Committee not later than thirty days before the succeeding annual meeting for preliminary printing.

c. Such reports shall be printed for distribution to the members on registering at the coming meeting; but no report shall be printed unless in the hands of the Publication Committee, as specified above.

11. The Publication Committee shall procure a copyright on the transactions in the name of the Association, and the committee shall have full charge of the publication of the transactions.

APPLICATION FOR MEMBERSHIP.

12. All applications for membership must be made upon the application blank of the Association.

13. Persons not members, having prepared papers to be presented at the meetings of the Association, shall be proposed for membership at the first business meeting of the Association.

EXPENDITURES.

14. All bills connected with the publication of the transactions shall, upon the approval of the chairman of the Publication Committee and the Secretary, be signed by the president of the Association, and paid by check of the Treasurer directly to the party concerned; and the President shall not approve any bill, relating either to publishing or printing, without the approval first of the chairman of the committee in charge thereof.

15. Bills for current expenses shall be first approved by the Secretary, then sent to the President, and on his approval they shall be paid by check of the Treasurer directly to the parties interested.

16. The actual and necessary traveling expenses of the Secretary and Treasurer to the annual meeting of the Association, and to one meeting of the Executive Committee, shall be classed as current expenses.

RESOLUTIONS.

17. All resolutions presented to the Association shall be sent to the Chair in writing, and referred to a committee without discussion.

ARREARAGES.

18. The arrearages of all members remitting their dues for two years shall be cancelled up to the date of the last payment, but they shall be entitled to the transactions of the Association only for the years for which they have actually paid.

AUDITING COMMITTEE.

19. An Auditing Committee shall be appointed by the Chair to audit the accounts of the Treasurer, and report upon the same.

OFFICERS AND COMMITTEES

OF THE

AMERICAN PUBLIC HEALTH ASSOCIATION.

OFFICERS, 1901-1902.

President.....Dr. Henry D. Holton, Brattleboro, Vt.
First Vice-President.....Dr. Walter Reed, Washington, D. C.
Second Vice-President.....Dr. Jésus Chico, Guanajuato, Mex.
Secretary.....Dr. Charles O. Probst, Columbus, O.
Treasurer.....Dr. Frank W. Wright, New Haven, Conn.

PRESIDENTS OF THE ASSOCIATION.

Stephen Smith, M. D.....1872, '73, '74
*Joseph M. Toner, M. D.....1875
*Edwin M. Snow, M. D.....1876
*John H. Rauch, M. D.....1877
*Elisha Harris, M. D.....1878
*James L. Cabell, M. D.....1879
John S. Billings, M. D.....1880
*Charles B. White, M. D.....1881
Robert C. Kedzie, M. D.....1882
*Ezra M. Hunt, M. D.....1883
*Albert L. Gihon, M. D.....1884
*James E. Reeves, M. D.....1885
Henry P. Walcott, M. D.....1886
George M. Sternberg, M. D.....1887
Charles N. Hewitt, M. D.....1888
*Hosmer A. Johnson, M. D.....1889
Henry B. Baker, M. D.....1890
Frederick Montizambert, M. D.....1891
Felix Formento, M. D.....1892
Samuel H. Durgin, M. D.....1893
Emmanuel P. Lachapelle, M. D.....1894
William Bailey, M. D.....1895
Eduardo Licéaga, M. D.....1896
*Henry B. Horlbeck, M. D.....1897
C. A. Lindsley, M. D.....1898
*George H. Rohé, M. D.....1899
Henry Mitchell, M. D.....1899
Peter H. Bryce, M. D.....1900
Benjamin Lee, M. D.....1901

*Deceased.

STANDING COMMITTEES.

EXECUTIVE COMMITTEE.

Dr. A. Walter Suiter.....Herkimer, N. Y.
Mr. Crosby Gray..... Pittsburg, Pa.
Dr. Fernando Lopez.....Mexico, D. F.
Dr. Gardner T. Swarts.....Providence, R. I.
Dr. W. C. Gorgas.....Havana, Cuba.
Dr. J. C. Shrader.....Iowa City, Iowa.

PUBLICATION COMMITTEE.

Dr. J. N. McCormack.....Bowling Green, Ky.
Dr. C. O. Probst.....Columbus, O.
Dr. Frank W. Wright.....New Haven, Conn.
Dr. Adolph Gehrmann.....Chicago, Ill.

(The President, *ex officio.*)

ADVISORY COUNCIL.

United States:	
Alabama.....	
Arkansas.....	
California.....	
Colorado.....	
Connecticut.....	Dr. Frank W. Wright, *New Haven.*
Cuba.....	Maj. W. C. Gorgas, *Havana.*
Delaware.....	W. C. R. Colquhoun, *Wilmington.*
Florida.....	
Georgia.....	
Illinois.....	Dr. Adolph Gehrmann, *Chicago.*
Indiana.....	Dr. William N. Wishard, *Indianapolis.*
Iowa.....	Dr. J. C. Shrader, *Iowa City.*
Kansas.....	
Kentucky.....	Dr. William Bailey, *Louisville.*
Louisiana.....	Dr. C. P. Wilkinson, *New Orleans.*
Maine.....	Dr. G. M. Woodcock, *Bangor.*
Maryland.....	Dr. John S. Fulton, *Baltimore.*
Massachusetts.....	Dr. S. H. Durgin, *Boston.*
Michigan.....	Dr. C. L. Wilbur, *Lansing.*
Minnesota.....	Dr. H. M. Bracken, *St. Paul.*
Mississippi.....	
Missouri.....	Dr. E. L. Standlee, *St. Louis.*
Nebraska.....	
New Hampshire.....	Dr. Wm. K. Robbins, *Manchester.*
New Jersey.....	Dr. John Lainy Leal, *Paterson.*
New Mexico.....	
New York.....	Dr. A. Walter Suiter, *Herkimer.*
North Carolina.....	Dr. R. H. Lewis, *Raleigh.*
North Dakota.....	Dr. H. D. Quarry, *Grand Forks.*
Ohio.....	Dr. Byron Stanton, *Cincinnati.*
Oklahoma Territory....	
Pennsylvania.....	Mr. Crosby Gray, *Pittsburg.*
Rhode Island.....	Dr. Gardner T. Swarts, *Providence.*

South Carolina..... Dr. Chas. M. Rees, *Charleston.*
South Dakota.....
Tennessee.....
Texas..... Dr. John Hicks Florence, *Dallas.*
Vermont..... Dr. Henry D. Holton, *Brattleboro.*
Virginia.....
Washington..... Dr. James B. Eagleson, *Seattle.*
West Virginia.....
Wisconsin..... Dr. Uranus O. B. Wingate, *Milwaukee.*
District of Columbia... Dr. William C. Woodward, *Washington, D. C.*
U. S. Army..... Dr. Walter Reed, *Washington, D. C.*
U. S. M. H. Service... Dr. P. H. Bailhache, *Washington, D. C.*
U. S. Navy.....

Canada:

Dominion of Canada... Dr. Frederick Montizambert, *Ottawa.*
Province of Ontario.... Dr. J. A. Amyot, *Toronto.*
Province of Quebec.... Dr. J. A. Beaudry, *Montreal.*
Manitoba..... Dr. Jno. A. Macdonald, *Brandon.*
New Brunswick..... Dr. E. Bayard Fisher, *Fredricton.*
Nova Scotia.....

Mexico:

Aguas Calientes..... Dr. Ysmael Prieto, *Mexico, D. F.*
Campeche..... Dr. Domingo Orvanaños, *Mexico, D. F.*
Colima.....
Coahulia..... Dr. David Cerna, *Saltillo.*
Chihuahua..... Dr. Miguel Marquez, *Chihuahua.*
Chiapas.....
Durango..... Dr. José L. Gomez, *Mexico, D. F.*
Guanajuato.....
Guerrero.....
Hidalgo.....
Jalisco..... Dr. Jésus Chico, *Guanajuato.*
Michoacán..... Dr. Francisco Bernaldez, *Mexico, D. F.*
Morelos..... Dr. Fernando Lopez, *Mexico, D. F.*
Mexico..... Dr. Ignacio Guzman, *Toluca.*
Nuevo León..... Dr. Pedro Noriega, *Monterey.*
Oaxaca..... Dr. Adelberto Carriedo, *Oaxaca.*
Puebla..... Dr. Nicolas R. de Arellano, *Mexico, D. F.*
Querètaro..... Dr. Augustin Ruiz Ollogui, *San Juan del Rio Qro.*
San Luis Potosi..... Dr. Jésus E. Monjarás, *San Luis Potosi.*
Sonora..... Dr. Angel Gaviño, *Mexico, D. F.*
Sinaloa..... Dr. Narciso del Rio, *Veracruz.*
Tabasco..... Dr. Gonzales Fabela, *Mexico, D. F.*
Tamaulipas..... Dr. Antonio Matienzo, *Tampico.*
Tlaxcala..... Dr. Luis Espinosa, *Jalapa.*
Veracruz..... Dr. Manuel Iglesias, *Veracruz.*
Yucatan..... Dr. Adolf Patron Martinez, *Merida.*
Zacatecas..... Dr. Juan Breña, *Zacatecas.*
Territorio de la Baja Calif.
Territorio de Tepic.....
Distrito Federal..... Dr. Eduardo Licéaga, *Mexico, D. F.*

SPECIAL COMMITTEES.

POLLUTION OF PUBLIC WATER SUPPLIES.

George W. Fuller.....New York City
Dr. Wyatt Johnston.....Montreal, P. Q.
Dr. José Ramirez.....Mexico, D. F.
Dr. A. C. Abbott.....Philadelphia, Pa.
Dr. John L. Leal.....Paterson, N. J.
Dr. Josiah Hartzell.....Canton, Ohio.
Dr. L. P. Kinnicutt.....Worcester, Mass.
Allen Hazen, C. E.....New York City.
Robert Spurr Weston, C. E.....Boston, Mass.
Dr. J. J. Mackenzie.....Toronto, Ont.
Dr. F. F. Wesbrook.....Minneapolis, Minn.
Rudolph Hering, C. E.....New York City.
F. Herbert Snow, C. E.....Boston, Mass.
Jno. W. Alvord, C. E.....Chicago, Ill.
Geo. H. Benzenberg, C. E.....Milwaukee, Wis.
Dr. U. O. B. Wingate.....Milwaukee, Wis.
F. H. Newell, C. E.....Washington, D. C.
Dr. John Amyot.....Toronto, Ont.
Mr. H. W. Clark.....Boston, Mass.

DISPOSAL OF REFUSE MATERIALS.

Rudolph Hering, C. E.....New York City.
Dr. Z. Taylor Emery.....Brooklyn, N. Y.
Dr. E. P. Lachapelle.....Montreal, P. Q.
Dr. Manuel Iglesias.....Veracruz, Mex.
Dr. Hibbert W. Hill.....Boston, Mass.
Dr. W. C. Woodward.....Washington, D. C.
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Mr. Geo. H. Benzenberg.....Milwaukee, Wis.
Dr. Byron Stanton.....Cincinnati, O.
Dr. W. G. Teichmann.....St. Louis, Mo.
Dr. George A. Soper.....New York, N. Y.

ANIMAL DISEASES AND ANIMAL FOOD.

D. E. Salmon, D. V. M.....Washington, D. C.
Dr. M. P. Ravenel.....Philadelphia, Pa.
Prof. José L. Gomez.....Mexico, D. F.
Dr. Henry M. Bracken.....St. Paul, Minn.
Dr. Jno. A. Macdonald.....Brandon, Mani.
J. I. Gibson, D. V. S.....Denison, Iowa.
Dr. Irving A. Watson.....Concord, N. H.
Dr. V. A. Moore.....Ithaca, N. Y.

CAR, STEAMSHIP AND STEAMBOAT SANITATION.

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Dr. John N. Hurty.....Indianapolis, Ind.
Dr. Granville P. Conn.....Concord, N. H.

Dr. Domingo Orvanaños.....Mexico, Mex.
Dr. S. H. Durgin.....Boston, Mass.
Dr. Alvah H. Doty.....Quarantine, S. I., N. Y.
Dr. C. P. Wilkinson.....New Orleans, La.
Dr. C. Hampson Jones.....Baltimore, Md.
Dr. Frank Warner.....Columbus, O.

ETIOLOGY OF YELLOW FEVER.

Dr. C. P. Wilkinson.....New Orleans, La.
Dr. Eduardo Licéaga.....Mexico, Mex.
Dr. Walter Reed.....Washington, D. C.
Dr. Walter Wyman, U. S. M. H. S.....Washington, D. C.
Dr. Alvah H. Doty.....Quarantine, S. I., N. Y.
Dr. J. J. Kinyoun, M. H. S.....Washington, D. C.

DEMOGRAPHY AND STATISTICS IN THEIR SANITARY RELATION.

[Uniform Municipal Statistics referred to this Committee.]

Dr. John S. Fulton.....Baltimore, Md.
Dr. Samuel W. Abbott.....Boston, Mass.
Dr. Charles V. Chapin.....Providence, R. I.
Dr. H. M. Bracken.....St. Paul, Minn.
Dr. Cressy L. Wilbur.....Lansing, Mich.
Dr. Wm. H. Welch.....Baltimore, Md.
Mr. M. N. Baker.....Montclair, N. J.
Dr. Wm. C. Woodward.....Washington, D. C.

CAUSE, PREVENTION, PERIOD OF INCUBATION AND DURATION OF INFECTIOUS DISEASES.

Dr. A. Walter Suiter.....Herkimer, N. Y.
Sur.-Gen. Geo. M. Sternberg, U. S. A.....Washington, D. C.
Dr. Jésus E. Monjarás.....San Luis Potosi, Mex.
Dr. W. C. Woodward.....Washington, D. C.
Dr. Frank W. Wright.....New Haven, Conn.
Dr. J. F. Kennedy.....Des Moines, Iowa.
Dr. A. R. Reynolds.....Chicago, Ill.
Dr. S. W. Battle.....Asheville, N. C.

PUBLIC HEALTH LEGISLATION.

Dr. U. O. B. Wingate.....Milwaukee, Wis.
Dr. Henry P. Walcott.....Cambridge, Mass.
Dr. C. O. Probst.....Columbus, Ohio.
Dr. A. H. Doty.....Quarantine, S. I., N. Y.
Dr. C. P. Wilkinson.....New Orleans, La.
Dr. A. R. Reynolds.....Chicago, Ill.
Dr. J. N. Hurty.....Indianapolis, Ind.
Dr. J. N. McCormack.....Bowling Green, Ky.
Dr. Charles A. Lindsley.....New Haven, Conn.
Dr. Richard H. Lewis.....Raleigh, N. C.

CAUSE AND PREVENTION OF INFANT MORTALITY.

Dr. Ernest Wende.....Buffalo, N. Y.
Dr. W. K. Jaques.....Chicago, Ill.

Dr. J. A. Amyot.....Toronto, Ont.
Dr. J. E. Monjarás.....San Luis Potosi, Mex.

DISINFECTANTS AND DISINFECTION.

Prof. Franklin C. Robinson.....Brunswick, Me.
Dr. Hibbert W. Hill.....Boston, Mass.
Dr. E. A. de Schweinitz.....Washington, D. C.
Dr. Adolph Gehrmann.....Chicago, Ill.
Mr. E. G. Horton.....Columbus, Ohio.
Dr. Chas. V. Chapin.....Providence, R. I.
Prof. L. P. Kinnicutt.....Worcester, Mass.
Dr. H. D. Pease.....Albany, N. Y.
Dr. M. P. Ravenel.....Philadelphia, Pa.
Dr. G. A. Charlton.....Montreal, P. Q.
Dr. E. H. Wilson.....Brooklyn, N. Y.
Dr. W. L. Buechner.....Youngstown, O.
Dr. F. Lopez.....Mexico, D. F.

NATIONAL LEPER HOMES.

Dr. H. M. Bracken.....St. Paul, Minn.
Dr. F. Montizambert.....Ottawa, Can.
Dr. Jésus Chico.....Guanajuato, Mex.
Dr. C. P. Wilkinson.....New Orleans, La.

DANGERS TO THE PUBLIC HEALTH FROM ILLUMINATING AND FUEL GAS.

Dr. Samuel H. Durgin.....Boston, Mass.
William Paul Gerhard, C. E.....New York City.

TRANSPORTATION OF DISEASED TISSUE BY MAIL.

Dr. F. F. Wesbrook.....Minneapolis, Minn.
Dr. Jno. S. Fulton.....Baltimore, Md.
Dr. J. A. Amyot.....Toronto, Ont.
Dr. Henry Mitchell.....Trenton, N. J.
Dr. Geo. E. Tyler.....Denver, Col.
Dr. Domingo Orvanaños.....Mexico, D. F.
Dr. Walter Wyman.....Washington, D. C.
Dr. Milton J. Rosenau.....Washington, D. C.

THE TEACHING OF HYGIENE AND GRANTING OF DIPLOMA OF DOCTOR OF PUBLIC HEALTH.

Dr. Wyatt Johnston.....Montreal, P. Q.
Dr. C. O. Probst.....Columbus, Ohio.
Prof. W. T. Sedgwick.....Boston, Mass.
Dr. A. C. Abbott.....Philadelphia, Pa.
Prof. F. C. Robinson.....Brunswick, Me.
Prof. Severance Burrage.....Lafayette, Ind.
Dr. C. H. Jones.....Baltimore, Md.
Dr. A. Walter Suiter.....Herkimer, N. Y.
Dr. James A. Exton.....Arlington, N. J.
Dr. Henry Mitchell.....Trenton, N. J.
Dr. J. F. Kennedy.....Des Moines, Iowa.

Dr. A. G. Young.....Augusta, Me.
Dr. José Ramirez.....Mexico, Mex.
Dr. Daniel Lewis.....New York City.

SANITARY AID SOCIETIES.

Dr. Geo. W. Goler.....Rochester, N. Y.
Miss Hester McClung.....Indianapolis, Ind.
Mr. Henry Lomb.....Rochester, N. Y.
Dr. Helen C. Putman.....Providence, R. I.

THE RELATIVE IMMUNIZING VALUE OF HUMAN AND BOVINE VACCINE VIRUS.

Dr. Peter H. Bryce.....Toronto, Ont.
Dr. Eduardo Licéaga.....Mexico, Mex.
Dr. Wm. M. Welch.....Philadelphia, Pa.

TO INVESTIGATE THE CANTEEN SYSTEM OF THE UNITED STATES ARMY.

Dr. C. A. Lindsley.....New Haven, Conn.
Dr. George M. Kober.....Washington, D. C.
Dr. S. H. Durgin.....Boston, Mass.
Dr. Helen C. Putnam.....Providence, R. I.
Dr. Jefferson D. Griffiths.....Kansas City, Mo.
Mr. Henry Lomb.....Rochester, N. Y.
Dr. J. H. Huddleston.....New York, N. Y.

SECTION OF BACTERIOLOGY AND CHEMISTRY.

OFFICERS AND COMMITTEES, 1901-1902.

Chairman..... Dr. F. F. Wesbrook, Minneapolis, Minn.
Vice-Chairman..... Dr. H. L. Russell, Madison, Wis.
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Recording Secretary.....Dr. H. D. Pease, Albany, N. Y.

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Dr. M. J. Rosenau.....Washington, D. C.
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Dr. Angel Gaviño.....Mexico, Mex.
Dr. Wyatt Johnston (ex-officio).....Montreal, P. Q.

STANDARD METHODS OF WATER ANALYSIS.

George W. Fuller.....New York, N. Y.
George C. Whipple.....Brooklyn, N. Y.
Harry W. Clark.....Boston, Mass.
Adolph Gehrmann, M. D.....Chicago, Ill.
Wyatt Johnston, M. D.....Montreal, P. Q.
E. O. Jordan, Ph. D.....Chicago, Ill.
H. L. Russell, Ph. D.....Madison, Wis.

BACTERIOLOGY OF MILK IN ITS SANITARY RELATIONS.

H. L. Russell.....Madison, Wis.

VARIATIONS OF THE COLON BACILLUS IN RELATION TO PUBLIC HEALTH.

Veranus A. Moore, M. D.....Ithaca, N. Y.
J. G. Adami, M. D.....Montreal, P. Q.
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Stephen DeM. Gage.....Lawrence, Mass.

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Dr. Hibbert W. Hill.....Boston, Mass.
Dr. Wm. G. Bissell.....Buffalo, N. Y.
Dr. Joseph McFarland.....Philadelphia, Pa.

REVISED LIST OF MEMBERS

AMERICAN PUBLIC HEALTH ASSOCIATION.

1901.

This list includes those who have maintained their membership to the present time, counting those joining in 1901. The Secretary should be notified of any errors or omissions.

MEMBERS.

Abbott, Samuel W., M. D.	Wakefield, Mass.	1882
*Abbott, Alex C. M. D.	University of Pennsylvania, Philadelphia, Pa.	1897
Adams, C. B., M. D.	Sac City, Iowa.	1900
Adams, Charles Everett, M. D.	29 W. Broadway, Bangor, Me.	1894
Adams, J. F. A., M. D.	Pittsfield, Mass.	1881
*Addy, G. A. B., M. D.	St. John, N. B.	1899
Alden, C. H., M. D., U. S. A.	Newtonville, Mass.	1887
Alexander, Edward, M. D.	El Paso, Tex.	1892
Allen, Kenneth, C. E.	Equitable Building, Baltimore, Md.	1899
Allen, Wm. Harvey.	University of Pennsylvania, Philadelphia, Pa.	1899
Alvord, J. W., C. E.	127 Hartford Building, Chicago, Ill.	1899
Amherst College Library.	Amherst, Mass.	1901
*Amyot, Jno. A., M. D.	30 St. Joseph St., Toronto, Ont.	1900
Anders, H. S., M. D.	1836 Wallace St., Philadelphia, Pa.	1897
Armitage, F. L., M. D.	Princeton, Minn.	1900
*Badger, Ernest F.	48 Weybosset St., Providence, R. I.	1900
Baker, Henry B., M. D.	Lansing, Mich.	1873
Bailey, Alfred W., M. D.	Atlantic City, N. J.	1899
Bailey, William, M. D.	Louisville, Ky.	1879
Bailhache, P. H., M. D., U. S. M. H. S.	Stapleton, N. Y.	1874
*Baldwin, E. R., M. D.	Saranac Lake, N. Y.	1899
Barbour, Frank A., C. E.	Tremont Bldg., Boston, Mass.	1900
Barnes, Henry Jabez, M. D.	429 Beacon St., Boston, Mass.	1896
Bartlett, James W.	Dover, N. H.	1888
Bartley, Elias Hudson, M. D.	21 Lafayette Ave., Brooklyn, N. Y.	1890
Bashore, Harvey B., M. D.	West Fairview, Pa.	1897
Beard, Richard O., M. D.	Minneapolis, Minn.	1899
Beaudrey, J. A., M. D.	65 St. Denis St., Montreal, P. Q.	1889
Beckwith, D. H., M. D.	94 Dorchester Ave., Cleveland, Ohio.	1884
Beebe, Henry E., M. D.	Sidney, Ohio.	1882
Belknap, Fred R., M. D.	Niles, Mich.	1900
Bell, A. N., M. D.	337 Clinton St., Brooklyn, N. Y.	1872
*Bell, Gordon, M. D.	Winnipeg, Manitoba.	1899
Bence, Geo. W., M. D.	Greencastle, Ind.	1900
Benzenberg, Geo. H., C. E.	436 Jefferson St., Milwaukee, Wis.	1900
Bernaldez, Francisco, M. D.	Estampa-Merced 5, Mexico, Mex.	1892

* Also Members of Section of Bacteriology and Chemistry.

Beshoar, Michael, M. D.	Trinidad, Col.	1895
*Bevier, Isabel	University of Illinois, Urbana, Ill.	1900
*Bissell, Wm. G., M. D.	143 Elmwood Ave., Buffalo, N. Y.	1900
Bitting, A. Wayne	313 State St., Lafayette Ind.	1900
Blackwell, Emily, M. D.	53 E. 20th St., New York, N. Y.	1873
Boardman, Wm. Frears	Ottawa, Ont.	1898
Board of Health	Erie, Pa.	1899
Board of Health	Manchester, N. H.	1899
*Bolling, Geo. E.	1257 Belmont St., Brockton, Mass.	1900
Bracken, Henry Martyn, M. D.	St. Paul, Minn.	1895
Brackett, C. F., M. D.	Princeton, N. J.	1899
Bradley, A. E., M. D.	Washington, D. C.	1899
Braunnagel, Julius, M. D.	Box 925, San Antonio, Tex.	1890
Breña, Juan, M. D.	Zacatecas, Mex.	1898
Brewer, Prof. William H., M. D.	New Haven, Conn.	1874
Brown, Edward J., M. D.	Minneapolis, Minn.	1899
Brown, Joseph O	Pittsburg, Pa.	1888
Bryce, George	Indianapolis, Ind.	1900
Bryce, Peter H., M. D.	Toronto, Ont.	1883
Buechner, W. L., M. D.	34 E. Federal St., Youngstown, Ohio.	1900
*Burrage, Severance, S. B.	Lafayette, Ind.	1897
Burroughs, Jas. A., M. D.	Asheville, N. C.	1898
Cabana, Louis V., M. D.	Fall River, Mass.	1898
*Caird, James M., M. D.	52 Powling Ave., Troy, N. Y.	1900
Cameron, Allen, M. D.	Owen Sound, Ont.	1886
Cameron, J. Chalmers, M. D.	941 Dorchester St., Montreal, P. Q.	1894
Campos, Juan N., M. D.	Toluca, Mex.	1899
*Carel, H. C.	Minneapolis, Minn.	1899
*Carmona y Valle, Manuel, M. D.	Mexico, Mex.	1892
Caverly, Charles S., M. D.	Rutland, Vt.	1894
Chaillé, Prof. Stanford E.	P. O. Drawer 261, New Orleans, La.	1874
*Chapin, Jules, M. D.	Montreal, P. Q.	1900
Chapman, W. C., M. D.	1708 Madison St., Toledo, Ohio.	1900
Chandler, Prof. C. F.	Columbia College, New York, N. Y.	1872
Chandler, David D.	74 No. 7th St., Newark, N. J.	1896
Chapin, Charles V., M. D.	Providence, R. I.	1886
Chase, Herman L., M. D.	Brookline, Mass.	1895
Chase, John C., C. E.	Derry, N. H.	1890
*Chester, F. D.	Path. and Bact. Lab., Newark, Del.	1899
Chico, Jésus, M. D.	2 Estrella St., Guanajuato City, Guanajuato, Mex.	1891
Church, Thomas Teasdale, M. D.	70 E. Main St., Salem, Ohio.	1890
*Clark, Harry W.	State House, Boston, Mass.	1896
Clark, J. Fred, M. D.	Fairfield, Ia.	1899
Coffey, James C.	Worcester, Mass.	1896
College of Medicine	Syracuse University, Syracuse, N. Y.	1899
Colquhoun, W. C. R., U. S. A.	San Juan, P. R.	1894
Conn, G. P., M. D.	Concord, N. H.	1875
*Connell, Walter Thomas, M. D.	Kingston, Ont.	1898
*Connelly, R. N., M. D.	Newark, N. J.	1898
Conner, P. S., M. D.	Cincinnati, Ohio.	1884

*Also Members of Section of Bacteriology and Chemistry.

Coon, Jno. W., M. D.	City Hall, Milwaukee, Wis.	1900
*Copeland, Wm. R.	Spring Garden Testing Station, Philadelphia, Pa.	1900
*Coplin, William L.	1629 So. Broad St., Philadelphia, Pa.	1897
Corbett, J. F., M. D.	2446 Park Ave., Minneapolis, Minn.	1899
Cowing, Hugh A., M. D.	210 High St., Muncie, Ind.	1900
Cox, Edgar, M. D.	13½ W. Mulberry St., Kokomo, Ind.	1900
Craig, G. G., M. D.	Rock Island, Ill.	1880
Craven, Macdonough, C. E.	263 82d St., Brooklyn, N. Y.	1899
Croes, J. James R., C. E.	68 Broad St., New York, N. Y.	1877
Currier, David M., M. D.	Newport, N. H.	1883
Curtis, George Francis, M. D.	West Newton, Mass.	1897
Curtis, F. C., M. D.	Albany, N. Y.	1883
Dalby, William Thomas, M. D.	Salt Lake City, Utah.	1894
*Davis, Floyd, Ph. D.	Des Moines, Iowa.	1890
Davis, N. S., M. D.	65 Randolph St., Chicago, Ill.	1887
Davis, T. Henry, M. D.	1021 Main St., Richmond, Ind.	1900
de Arellano, Nicolas R., M. D.	Mexico, Mex.	1900
Dedrick, Albert C., M. D.	247 No. Main St., Fall River, Mass.	1900
de la Roché, C. P., M. D.	1518 Pine St., Philadelphia, Pa.	1897
del Rio, Narciso, M. D.	Veracruz, Mex.	1899
Dennis, Laban, M. D.	30 Central St., Newark, N. J.	1877
*de Schweinitz, Emil A., M. D.	Washington, D. C.	1896
Didlake, Madison T., M. D.	Monticello, Ind.	1900
Disbrow, Wm. S., M. D.	Newark, N. J.	1899
Dodds, Wm. T. S., M. D.	18 Ohio St., Indianapolis, Ind.	1900
Dodge, William E., Jr.	11 Cliff St., New York, N. Y.	1874
*Dorset, Marion, M. D.	Bureau Animal Industry, Washington, D. C.	1900
Doty, Alvah H., M. D.	Quarantine, Staten Island, N. Y.	1896
Drew, Charles W., M. D.	505 Century Bldg., Minneapolis, Minn.	1899
*Drown, Thomas M., M. D.	South Bethlehem, Pa.	1887
Dudley, Charles P., M. D.	Altoona, Pa.	1888
*Dunham, E. K., M. D.	338 26th St., New York, N. Y.	1897
Durgin, Samuel H., M. D.	12 Beacon St., Boston, Mass.	1875
Eagleson, James B., M. D.	Burke Building, Seattle, Wash.	1896
Egan, J. A., M. D.	Springfield, Ill.	1897
Elgin, W. F., M. D.	Glenolden, Pa.	1900
*Ellms, J. W.	East Court and Martin Sts., Cincinnati, Ohio.	1897
Elsner, John, M. D.	Denver, Col.	1887
*Emerson, H. C., M. D.	Springfield, Mass.	1899
*Ernst, Harold C., M. D.	Harvard Medical School, Boston, Mass.	1899
Exton, James A., M. D.	75 Beech St., Arlington, N. J.	1897
Fairfield, Wm. J., M. D.	1302 Meridian St., Anderson, Ind.	1900
Fales, Frank L., C. E.	City Hall, Cincinnati, Ohio.	1893
Farnham, Edwin, M. D.	Cambridge, Mass.	1889
Farquhar, A. B., Esq.	York, Pa.	1880
Fenton, Thomas H., M. D.	1319 Spruce St., Philadelphia, Pa.	1897
Ferguson, F., M. D.	20 W. 38th St., New York, N. Y.	1892
Flanned, Frank W.	4020 No. Meridian St., Indianapolis, Ind.	1900
Fleischmann, Louis, M. D.	788 Broadway, New York, N. Y.	1890

*Also Members of Section of Bacteriology and Chemistry.

Flick, Lawrence F., M. D.	736 Pine St., Philadelphia, Pa.	1890
Florence, John H., M. D.	Dallas, Texas.	1899
Foote, Charles Jenkins, M. D.	26 Elm St., New Haven, Conn.	1895
Force, Jno. P., C. E.	Columbus, Ohio.	1900
*Ford, W. W., M. D.	McGill University, Montreal, P. Q.	1900
Formento, Felix, M. D.	New Orleans, La.	1880
*Freeman, R. G., M. D.	478 W. 59th St., New York, N. Y.	1899
Fries, Albert, M. D.	92 Reade St., New York, N. Y.	1897
*Frost, Prof. Wm. D.	Madison, Wis.	1899
*Fuller, George W.	100 Williams St., New York, N. Y.	1892
Fulton, John S., M. D.	10 South St., Baltimore, Md.	1897
Furniss, Henry W., M. D.	Bahia, Brazil.	1900
Gable, Isaac C., M. D.	26 South St., York, Pa.	1897
Garciadiego, Salvador, M. D.	Guadalajara, Jalisco, Mex.	1892
Gaviño, A., M. D.	Ratas No. 4, Mexico, Mex.	1891
*Gehrmann, Adolph, M. D.	3816 Ellis St., Chicago, Ill.	1895
Gemmill, W. T., M. D.	Forest, Ohio.	1900
Gerhard, Wm. Paul, C. E.,	33 Union Square West, New York, N. Y.	1880
Gerrish, Frederic H., M. D.	Portland, Me.	1885
Gibson, J. I., V. S.	Denison, Iowa.	1898
*Gilliland, S. H., M. D.	3608 Pine St., Philadelphia, Pa.	1900
Glover, John F., M. D.	Woodmere St., Evansville, Ind.	1900
Goler, Geo. W., M. D.	127 East Ave., Rochester, N. Y.	1900
*Gomez, José L., M. D.	Mexico, Mex.	1899
Goodwin, R. S., M. D.	Thomaston, Conn.	1886
*Gorham, Fred P.	Providence, D. I.	1899
Graves, E. E., M. D.	Penacook, N. H.	1886
Graves, Prof. Henry S.	Yale University, New Haven, Conn.	1900
Gray, Crosby	Pittsburgh, Pa.	1874
Gray, Samuel M., C. E.	10 Weybosset St., Providence, R. I.	1891
Gutierrez, Manuel, M. D.	13 Aduana Vieja, Mexico, Mex.	1891
Guzman, Ignacio, M. D.	Toluca, Mex.	1900
Hagey, Jacob Moyer, M. D.	Mt. Morris, N. Y.	1892
*Harris, Norman McL., M. D.	Baltimore, Md.	1899
Harris, R. W., M. D.	621 Vincennes St., New Albany, Ind.	1900
Harrison, George Wood, M. D.	404 Second St., Ashland, Wis.	1896
Hart, James A., M. D.	802 N. Nevada Ave., Colorado Springs, Col.	1895
Hartzell, Josiah, Ph. D.	Canton, Ohio.	1895
Harvard College Library	Cambridge, Mass.	1900
Haskell, W. A., M. D.	Alton, Ill.	1883
Hayes, Franklin W., M. D.	235 N. Penn. St., Indianapolis, Ind.	1900
*Hazen, Allen, C. E.	220 Broadway, New York, N. Y.	1892
Heffron, John Lorenzo, M. D.	448 S. Salina St., Syracuse, N. Y.	1894
*Hektoen, Ludwig, M. D.	Rush Medical College, Chicago, Ill.	1899
Hengerer, William	Buffalo, N. Y.	1896
Hering Rudolph, C. E.	100 Williams St., New York, N. Y.	1878
Herold, H. C. H., M. D.	Newark, N. J.	1898
Hicks, Charles A., M. D.	Fall River, Mass.	1897
Hill, G. Everett	156 Fifth Ave., New York, N. Y.	1897.

*Also Members of Section of Bacteriology and Chemistry.

*Hill, Hibbert W., M. D.....Sudbury and Hawkins Sts., Boston, Mass. 1896
Hill, John W., C. E.....City Hall, Philadelphia, Pa. 1896
*Hiss, Philip H., Jr., M. D.....Washington Sq. No., New York, N. Y. 1899
Hohenschuh, W. P.....Iowa City, Ia. 1899
Holmes, A. Mansfield, M. D.....Denver, Col. 1899
Holton, Henry D., M. D.....Brattleboro, Vt. 1875
Hopkins, Henry R., M. D.....433 Franklin St., Buffalo, N. Y. 1894
*Horton, Elmer G., B. S.....Columbus, Ohio. 1897
Hoskins, Horace D., D. V. S.....3452 Ludlow St., Philadelphia, Pa. 1897
Howe, Lucien, M. D.....183 Delaware Ave., Buffalo, N. Y. 1896
*Huddleston, J. H., M. D.....126 W. 85th St., New York, N. Y. 1899
Hunt, A. Clark, M. D.....Metuchen, N. J. 1888
Hunt, C. C., M. D.....Dixon, Ill. 1889
Hunt, Simeon, M. D....Warren Ave. and 2d St., East Providence, R. I. 1896
Hunter, Chas. H., M. D.....13 Syndicate Block, Minneapolis, Minn. 1899
Hurty, John N., M. D.....29 East Second St., Indianapolis, Ind. 1896
Hutchinson, Henry, M. D.....St. Paul, Minn. 1899

Iglesias, Manuel S., M. D.....Veracruz, Mex. 1900

*Jackson, Daniel D.,
Flatbush Ave. and Eastern Parkway, Brooklyn, N. Y. 1899
James, Bushrod W., M. D...Cor. 18th and Green Sts., Philadelphia, Pa. 1878
Johnson, Chas. B., M. D.....Champaign, Ill. 1897
*Johnson, Geo. A.....1141 Market St., St. Louis, Mo. 1900
*Johnston, Wyatt, M. D.....76 Rue Ste. Gabriel, Montreal, P. Q. 1892
Jones, C. Hampson, M. D.....211 W. Franklin St., Baltimore, Md. 1898
Jones, D. C., M. D.....Danville, Ill. 1900
Jones, Leander P., M. D.....Greenwich, Conn. 1889
Jones, S. Case, M. D.....21 East Ave., Rochester, N. Y. 1895
Jones, S. S., M. D.....Frazee, Minn. 1899
*Jordan, Edwin O.....University of Chicago, Chicago, Ill. 1899

Kellogg, J. H., M. D.....Battle Creek, Mich. 1878
Kelso, Wilbur M.....5833 Monroe Ave., Chicago, Ill. 1899
Kennedy, J. F., M. D.....Des Moines, Iowa. 1885
Karsner, Charles W., M. D.....1320 So. Broad St., Philadelphia, Pa. 1897
Kimball, James P., M. D., U. S. A.....Garden City, N. Y. 1892
*Kinnicutt, Leonard P., S. D.....Worcester, Mass. 1899
*Kneass, S. S., M. D.....1510 Walnut St., Philadelphia, Pa. 1899
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*Whipple, Geo. C..Flatbush Ave. and Eastern Parkway, Brooklyn, N. Y. 1899
White, Alfred T., M. D.....Box 619, New York, N. Y. 1889
White, William A., M. D.....Box 619, New York, N. Y. 1888
Whitney, Prof. Eli.....Yale University, New Haven, Conn. 1900
Wilbur, Cressy L., M. D.....Lansing, Mich. 1894
Wilkinson, C. P., M. D.....1402 Peters Ave., New Orleans, La. 1889
Willcox, W. F.....Cornell University, Ithaca, N. Y. 1899
*Wilson, Ezra H., M. D.....Hoagland Laboratory, Brooklyn, N. Y. 1897
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Wingate, Uranus Owen Brackett., M. D.,
204 Biddle St., Milwaukee, Wis. 1890
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Wood, Prof. Edward S.....Harvard Medical School, Boston, Mass. 1895
Woodbridge, Prof. S. H.....Boston, Mass. 1895
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INDEX.

A

Abbott, A. C.,
University Teaching in Hygiene 94
Discussion of Papers on Tuberculosis 328
A Brief Statement of Sanitary Work in the Philippine Islands, etc 157
Address of Welcome 14
Advisory Council, Report of 369
Agglutinins, Antitoxins and 417
Air Testing for Engineers 467
Algæ, Blue-Green, Some Points in the Life History and in the Decomposition of 467
Amyot, John A.,
Is the Colon Bacillus a Normal Inhabitant of the Intestines of Fishes? 400
An Engineer's Kit for Water Inspection 478
Animal Diseases and Animal Food, Report of Committee on 45
Anti-Rabic Department of the Supreme Board of Health of Mexico 318
Antitoxin Preparations, Refined and Improved 414
Antitoxins and Agglutinins 417
Architects and Engineers, Instruction in Hygiene for 92
Army Canteen, Resolutions in re 322, 343, 367
Army Canteen, Some Results of the, from the Standpoint of Discipline and Hygiene 315
Auditing Committee, Appointment of 363
Auditing Committee, Report of 372

B

Bacillus Coli, Remarks Regarding the Investigation of, in Water 408
Bacteria, Some Common, in American Streams 402
Bailey, William,
Remarks on the Death of President McKinley 364
Barnes, Henry J.,
Discussion of Papers on School Hygiene 373
Discussion of Report on Car Sanitation 361
Bartley, Elias H.,
Some of the Causes of Infant Mortality in Nurseries and Asylums .. 306
Beckwith, D. H.,
Discussion of Papers on Vaccination 341
Bell, A. N.,
Fomites and Yellow Fever 144
Bernaldez, Francisco De,
Humanized Vaccine as a Preventative of Smallpox 182
Boston, Refuse Disposal in 186
Bovine Tuberculosis, Some Facts which Tend to Show that, Can be the Source of the Same Disease in Man 78

Bracken, Henry M., Chairman,
Report of Committee on National Leper Homes....34, 323
Breña, Juan, .
Notes on the Necessity of Attending to the Hygiene of the Mouth Amongst the Pupils of Schools.... 286
Brewer, William H.,
Discussion of Papers on Tuberculosis.... 327
Discussion of Report on Car Sanitation.... 361
Brewer, William H., Chairman,
Report of Committee on the Relation of Forestry to the Public Health 209
British Congress on Tuberculosis.... 35
Bryce, Peter H.,
Discussion of Papers on Tuberculosis.... 325
Discussion of Papers on Vaccination.... 342
Remarks on the Death of President McKinley.... 365
Vaccinal Immunization from the Health Officer's Standpoint.... 175
Burr, Alexander, and Hill, Hibbert W.,
Methods of Diagnosis in Glanders.... 439
By-Laws of the Executive Committee.... v

C

Carbon Di-oxide, Significance of in Potable Waters.... 411
Carriedo, A.,
Sanatoria for Consumptives.... 85
Carroll, James, and Reed, Walter,
The Prevention of Yellow Fever.... 113
Car Sanitation, Report of Committee on.... 224
Car Sanitation, Discussion of Report on.... 360
Chapman, William C.,
Discussion of Papers on Tuberculosis.... 330
Chico, Jésus,
Some Facts which Tend to Show that Bovine Tuberculosis Can be the Source of the Same Disease in Man.... 78
Clark. H. W.,
The Bacterial Purification of Water by Freezing.... 204
The Non-Nitrification of Septic Sewage in Contact Filters.... 464
Colon Bacillus, Is the, a Normal Inhabitant of the Intestines of Fishes.... 400
Committees, List of.... 368
Committees, Members of.... viii
Constitution i
Consumptives, Sanatoria for.... 85
Contact Filters, The Non-Nitrification of Septic Sewage in.... 464
Cremation in Relation to Sanitary Legislation.... 314
Cultivation of the Bacillus Influenza.... 458

D

Demography and Statistics in Their Sanitary Relation.... 305
Demonstration of the Existence of Typhoid Fever in the City of Mexico by the Widal Method.... 437
de Schweinitz, E. A.,
Discussion of Papers on Tuberculosis.... 324

Diphtheria, Present Status of..... 238
Diseased Tissue, Transportation of by Mail..... 27
Disinfectants and Disinfection, Report of Committee on..... 244
Disinfectants and Disinfection, Report of Sub-Committee on Standard Cultures and How to Use Them..... 247
Disinfection, Practice of in the Federal District of Mexico..... 253
Disposal of Refuse Materials..... 184
District of Columbia, Refuse Disposal in..... 194
Doty, Alvah H.,
Practical Discussion of Yellow Fever..... 134
Durgin, Samuel H.,
Discussion of Report on Car Sanitation..... 360
Discussion of Report on Disposal of Refuse Materials..... 357
Discussion of Papers on Tuberculosis..... 332
Discussion of Papers on Vaccination..... 339

E

Elgin, W. F.,
Discussion of Papers on Vaccination..... 340
Engineers, Air Testing for..... 477
Espinoza, Luis G.,
Cremation in Relation to Sanitary Legislation..... 314

F

Fabela, Gonzales,
Remarks Regarding the Investigatin of Bacillus Coli in Water..... 408
Fishes, Is the Colon Bacillus a Normal Inhabitant of the Intestines of.... 400
Fomites and Yellow Fever..... 144
Forestry, The Relation of to the Public Health..... 209
Formento, Felix,
Discussion of Papers on Vaccination..... 339
Discussion of Papers on Yellow Fever..... 349
Tuberculosis: Heredity 81
Fuller, George W., Chairman,
Report of Committee on Pollution of Public Water Supplies.....100, 346
Report of Committee on Standard Methods of Water Analysis..... 377
Fulton, John S., and Stokes, William R.,
Hydrocyanic Acid Gas in Public Health Work..... 469
Some Work on a Curative Serum for Typhod Fever..... 423
Fulton, John S., Chairman,
Report of Committee on Demography and Statistics in Their Sanitary Relation 305

G

Gage, Stephen DeM., and Phelps, Earle B.,
Studies of Media for the Quantitative Estimation of Bacteria in Water and Sewage..... 392
Gaviño, Angel,
Demonstration of Typhoid Fever by the Widal Method..... 437
Gehrmann, Adolph,
Cultivation of the Bacillus Influenza..... 458
Gibson, J. I.,
Discussion of Papers on Tuberculosis.....331, 335

Gihon, A. L.,
Discussion on Army Canteen..... 344
Discussion of Papers on School Hygiene..... 373
Remarks by..... 319
Glanders, Methods of Diagnosis in..... 439
Gorgas, W. C.,
The Results of Yellow Fever Sanitation in Havana..... 130
Greenleaf, Charles R.,
Sanitary Work in the Philippine Islands..... 157
Discussion on Army Canteen..... 344
Guzman, Ignacio,
Advisability of Entrusting to Physicians and not to Teachers the Medical Supervision of Pupils..... 304

H

Hering, Rudolph, Chairman,
Report of Committee on Disposal of Refuse Materials..... 184
Discussion of Report on Disposal of Refuse Materials..... 357
Hill, Hibbert W., and Burr, Alexander,
Methods of Diagnosis in Glanders..... 439
Hill, Hibbert W.,
Refuse Disposal in Boston..... 186
Report of Committee on Disinfectants and Disinfection..... 244
Horlbeck, H. B.,
Committee on Resolutions on Death of..... 371
Holton, Henry D.,
Remarks on the Death of President McKinley..... 320
Remarks by..... 374
Holton, Henry D., Treasurer,
Report of..... 371
Hygiene, Instruction in, for Architects and Engineers.....92, 338
Hygiene, Instruction in, for Veterinary Students..... 99
Hygiene, Report of Committee on Teaching of..... 87
Hygiene, University Teaching in..... 94
Hygiene of the Mouth, Necessity of Attending to..... 286
Hydrocyanic Acid Gas in Public Health Work..... 469

I

Infant Mortality, Some of the Causes of in Nurseries and Asylums..... 306
Infectious Diseases, Report of Committee on the Cause, Prevention and Duration of..... 227
Influenza, Cultivation of the Bacillus of..... 458
Instruction in Hygiene for Architects and Engineers..... 92
Instruction in Hygiene for Veterinary Students..... 99
Is the Colon Bacillus a Normal Inhabitant of the Intestines of Fishes?... 400

K

Kendall, Arthur I., and Weston, Robert Spurr,
Some Common Bacteria in American Streams..... 462

L

Leal, J. L.,
The Legal Aspects of Water Pollution..... 103

Learned, John B.,
Discussion of Papers on Tuberculosis..... 335
Lee, Benjamin,
President's Annual Address..... 1
Remarks by 319, 375
Response to Address of Welcome..... 17
Legislation, Cremation in Relation to Sanitary..... 314
Legislation, Report of the Committee on Public Health..... 257
Leper Homes, Report of Committee on..... 34
Licéaga, Eduardo,
Anti-Rabic Department of the Supreme Board of Health of Mexico 318
Discussion of Papers on Vaccination..... 339
Remarks on Death of President McKinley.....321, 367
Tenth Report on Yellow Fever in Mexico..... 152
Lindsley, C. A.,
Discussion of Papers on Tuberculosis..... 334
Resolution on Army Canteen..... 322
Local Committee of Arrangements, Report of..... 320
Lopez, Fernando,
Observations on the Practice of Disinfection in the Federal District of Mexico 253

M

McFarland, Joseph,
Refined and Improved Antitoxin Preparations..... 414
McKinley, William,
Committee on Resolutions on the Death of..... 322
Resolution on the Death of..... 363
Remarks on the Death of.....321, 364
Madsen, Thorvald,
Antitoxins and Agglutinins..... 417
Medical Supervision of Pupils, Advisability of Entrusting to Physicians and Not to Teachers..... 304
Members, List of..... xvi
Members by Geographical Distribution..... xxvii
Methods of Diagnosis in Glanders..... 439
Milk. The Bacterial Contamination of..... 461
Mitchell, Henry, Chairman,
Report of Committee on School Hygiene..... 260
Montgomery, L. H.,
Resolution on Tuberculosis..... 339
Montizambert, F.,
Remarks on Death of President McKinley..... 321
Remarks by..... 320
Report on the British Congress on Tuberculosis..... 35
Mosher, Eliza M.,
Discussion on Report on Car Sanitation..... 360
Discussion of Papers on Tuberculosis..... 337
Mouth, Hygiene of the..... 286
Munson, Edward L.,
Some Results of the Army Canteen or Post Exchange from the Standpoint of Discipline and Hygiene..... 315

N

National Leper Homes, Report of Committee on..... 323
Notes on the Necessity of Attending to the Hygiene of the Mouth Amongst Pupils of Schools..... 286

O

Observations on the Practice of Disinfection in the Federal District of Mexico 253
Officers and Committees, List of..... viii
Officers, Election of for 1902..... 370
On the Progress of Health Organizations in the United States..... 19

P

Park, William Hallock,
The Bacterial Contamination of City Milk..... 461
Phelps, Earle B., and Gage, Stephen DeM.,
Studies of Media for the Quantitative Estimation of Bacteria in Water and Sewage..... 392
Philippine Islands, Sanitary Work Accomplished in, and Present Sanitary Administratin of..... 157
Plague Bacillus, The Viability of the, in Its Relation to the Public Health. 448
Pollution of Public Water Supplies, Report of Committee on.....100, 346
Porto Rico, Sanitation in..... 166
Practical Discussion of Yellow Fever..... 134
Present Status of Diphtheria..... 238
President's Annual Address..... 1
Proceedings of the Twenty-ninth Annual Meeting..... 319
Program, Discussion on Printing of..... 372
Public Health Legislation, Report of Committee on..... 257
Public Health, The Relation of Forestry to..... 209

R

Ravenel, M. P.,
Instruction in Hygiene for Veterinary Students..... 99
Reed, Walter,
Discussion of Papers on Yellow Fever..... 354
Reed, Walter, and Carroll, James,
The Prevention of Yellow Fever..... 113
Refined and Improved Antitoxin Preparations..... 414
Refuse Materials, Disposal of..... 184
Refuse Materials, Discussion of Report on..... 357
Refuse Disposal in Boston..... 186
Refuse Disposal in the District of Columbia..... 194
Remarks Intended to Show the Innocuous Character of Humanized Virus as a Preventative of Smallpox..... 182
Remarks Regarding the Investigatioin of Bacillus Coli in Water..... 408
Report of Advisory Council..... 369
Report of Committee on Animal Diseases and Animal Food..... 45
Car Sanitation 224
Cause, Prevention and Duration of Infectious Diseases..... 227
Demography and Statistics in Their Sanitary Relation..... 305
Disinfectants and Disinfection..... 244
Disposal of Refuse Materials..... 184

Report of Committee on National Leper Homes 34, 323
Pollution of Public Water Supplies.....100, 346
Public Health Legislation..... 257
Sanitary Aid Societies..... 367
School Hygiene 260
Standard Methods of Water Analysis..... 377
Teaching of Hygiene and Granting of Diploma of Doctor of Public Health 87
The Relation of Forestry to the Public Health..... 209
Transportation of Diseased Tissue by Mail..... 27
Report of Sub-Committee on Standard Cultures and the Methods of Using Them 247
Resolution in re Army Canteen.....322, 343, 367
Committee to Investigate the Problem of How Best to Secure to the Public Supplies of Normal Vaccine..... 345
Death of President McKinley..... 363
Sanitary Aid Societies..... 368
Tuberculosis 339, 348
Response to Address of Welcome..... 17
Richards, Ellen H.,
Air Testing for Engineers..... 477
An Engineer's Kit for Water Inspection..... 478
Some Points in the Life History and in the Decomposition of Blue-Green Algæ 467
The Significance of the Presence and Amount of Carbon Di-oxide in Potable Waters 411
Rosenau, Milton J.,
Discussion of Papers on Yellow Fever..... 353
The Viability of the Plague Bacillus in Its Relation to the Public Health 448

S

Salmon, D. E., Chairman,
Report of Committee on Animal Diseases and Animal Food..... 45
Sanatoria for Consumptives..... 85
Sanitary Aid Societies, Report of Committee on..... 367
Sanitary Aid Societies, Resolution in re..... 368
Sanitary Authorities and Associations..... xxxv
Sanitation in Porto Rico..... 166
School Hygiene, Discussion of Papers on..... 373
School Hygiene, Report of Committee on..... 260
School Life, Influence of, Over Health..... 297
Section of Bacteriology and Chemistry, Officers and Committees of..... xv
Transactions of 377
Sedgwick, W. T.,
Instruction in Hygiene for Architects and Engineers..... 92
Sedgwick, W. T., Chairman,
Report of Committee on Teaching of Hygiene and Granting of Diploma of Doctor of Public Health..... 87
Sewage, Studies of Media for the Quantitative Estimation of Bacteria in.. 392
Sewage, The Non-Nitrification of in Contact Filters..... 464

Shrader, John C.,
Discussion of Papers on Tuberculosis..... 329
Smallpox, Humanized Vaccine as a Preventative of..... 182
Smith, William F.,
Discussion of Papers on Tuberculosis..... 333
Sanitation in Porto Rico..... 166
Smith, Stephen,
On the Progress of Health Organizations in the United States.... 19
Some Common Bacteria in American Streams..... 402
Some Facts which Tend to Show that Bovine Tuberculosis Can be the Source of the Same Disease in Man..... 78
Some of the Causes of Infant Mortality in Nurseries and Asylums..... 306
Some Points in the Life History and in the Decomposition of the Blue Green Algæ as Illustrated by Oscillaria Prolifica..... 467
Some Results of the Army Canteen or Post Exchange from the Standpoint of Discipline and Hygiene..... 315
Some Work on a Curative Serum for Typhoid Fever..... 423
Standard Methods of Water Analysis, Report of Committee on..... 377
State Boards of Health, Members of..... xxxv
Stokes, William R., and Fulton, John S.,
Hydrocyanic Acid Gas in Public Health Work..... 409
Some Work on a Curative Serum for Typhoid Fever..... 423
Studies of Media for the Quantitative Estimation of Bacteria in Water and Sewage..... 392
Suiter, A. Walter, Chairman,
Report of Committee on Cause, Prevention and Duration of Infectious Diseases..... 227

T

Tenth Report on Yellow Fever in Mexico..... 152
The Advisability of Entrusting to Physicians and Not to Teachers the Medical Supervision of Pupils..... 304
The Bacterial Contamination of City Milk..... 461
The Bacterial Purification of Water by Freezing..... 204
The Influence of School Life Over Health..... 297
The Legal Aspects of Water Pollution..... 103
The Non-Nitrification of Septic Sewage in Contact Filters..... 464
The Prevention of Yellow Fever..... 113
The Results of Yellow Fever Sanitation in Havana, Cuba, Upon the Basis that the Stegomyia Mosquito is the Sole Means of Its Transmission.. 130
The Significance of the Presence and Amount of Carbon Di-oxide in Potable Waters..... 411
The Viability of the Plague Bacillus in Its Relation to the Public Health.. 448
Treasurer's Report..... 371
Tuberculosis, Discussion of Papers on..... 324
Resolutions in re.....339, 348
Tuberculosis: Heredity..... 81
Tuberculosis, Some Facts which Tend to Show that Bovine, Can be the Source of the Same Disease in Man..... 78
Tuberculosis, The British Congress on..... 35
Typhoid Fever..... 241

Typhoid Fever Death Rates in American Cities..... 100
Typhoid Fever, Demonstration of by Widal Method..... 437
Typhoid Fever, Some Work on a Curative Serum for..... 423

U

University Teaching in Hygiene..... 94

V

Vaccinal Immunization from the Health Officer's Standpoint..... 175
Vaccination, Discussion of Papers on..... 339
Vaccine, Humanized, as a Preventative of Smallpox..... 182
Vaccine, Resolution in re..... 345
Veterinary Students, Instruction in Hygiene for..... 99

W

Wasdin, Eugene,
Discussion of Papers on Yellow Fever..... 350
Water Analysis, Report of Committee on Standard Methods of..... 377
Water Inspection, An Engineer's Kit for..... 478
Water Pollution, The Legal Aspects of..... 103
Water, Studies of Media for the Quantitative Estimation of Bacteria in.. 392
Water, The Bacterial Purification of, by Freezing..... 204
Wesbrook, F. F., Chairman,
Report of Committee on Transportation of Diseased Tissue by Mail. 27
Weston, Robert S., and Kendall, Arthur I.,
Some Common Bacteria in American Streams..... 402
Widal Method, Demonstration of Typhoid Fever by..... 437
Wilcox, Ansley,
Address of Welcome..... 14
Wilkinson, C. P.,
Remarks on Death of President McKinley..... 365
Wilson, E. H., Chairman,
Report of Sub-Committee on Standard Cultures and the Method of Using Them 247
Wingate, U. O. B., Chairman,
Report of Committee on Public Health Legislation..... 257
Woodbridge, S. H., Chairman,
Report of Committee on Car Sanitation..... 224
Woodward, W. C.,
Refuse Disposal in the District of Columbia..... 194
Present Status of Diphtheria..... 238
Wright, Frank W.,
Influence of School Life Over Health..... 297
Typhoid Fever 241

Y

Yellow Fever, Discussion of Papers on..... 349
Yellow Fever, Fomites and..... 144
Yellow Fever, Practical Discussion of..... 134
Yellow Fever, Report of Committee on..... 347
Yellow Fever, Tenth Report on in Mexico..... 152
Yellow Fever, The Prevention of..... 113
Yellow Fever, The Results of, Sanitation in Havana, Cuba..... 130